सत्यमेव जयते

REPORT
ON
NATIONAL WATER SUPPLY
AND
SANITATION SCHEMES

COMMITTEE ON PLAN PROJECTS
(Buildings Projects Team)
NEW DELHI
June 1961

Composition of the Team for Selected Buildings Projects.

Leader

Shri S. K. Patil Minister for Food and Agriculture.

Members

Shri Sarup Singh, ISE (Retd.), formerly Director, National Buildings Organisation.

Shri N. G. Dewan, ISE, Chief Engineer, Central Public Works Department.

Maj.-Gen. Harkirat Singh, Engineer-in-Chief, Army Headquarters, New Delhi.

Dr. Eng. A. Carbone, Consulting Engineer, Calcutta.

Shri C. P. Malik. Director, National Buildings Organisation (*ex-officio*).

Member-Secretary

Shri T. S. Vedagiri. Superintending Engineer.

Composition of the Panel for National Water Supply & Sanitation Schemes.

सत्यमेव जयते

Chairman

Shri N. V. Modak, Director, Central Public Health Engineering Research Institute, Civil Lines, Nagpur.

Members

Shri P. C. Bose, Chief Engineer, Public Health Deptt., Government of West Bengal, Calcutta.

Shri R. D. Varma, Chief Engineer, L.S.G. Engg. Deptt., Govt. of U.P., Lucknow.

Shri S. Rajagopalan, Asstt. Director General (PHE), Ministry of Health, New Delhi.

Member-Secretary

Shri T. S. Vedagiri, Member-Secretary, Buildings Projects Team.

MINISTER FOR
FOOD AND AGRICULTURE,
GOVERNMENT OF INDIA
New Delhi, January 10, 1961

My Dear Pantji,

I have great pleasure in forwarding herewith the report of the Selected Buildings Projects Team on National Water Supply & Sanitation Schemes. You will recall that this subject was taken up for detailed study and evaluation by the Team in consultation with the Ministry of Health. The study was undertaken by a specialist Panel set up for this purpose under the Chairmanship of Shri N. V. Modak, Director, Central Public Health Engineering Research Institute at Nagpur. The Chief Engineer, Public Health Engg. Deptt., West Bengal, the Chief Engineer, Local Self-Govt. Engg. Deptt., U.P. and the Asst. Director General, (Public Health Engg.), of the Ministry of Health, were the other Members of the Panel.

The Panel examined the water supply and sanitation schemes of a number of States and had discussions with the officials concerned and also with Ministers and Chief Ministers in some of the States. During the final phase of its work, the Panel had joint visits and discussions with the TCM Team of Public Health Engineers invited by the Union Ministry of Health to report on the National Water Supply and Sanitation Programme. This report of the Panel is based on the detailed studies of a number of water supply and sanitation schemes and the discussions the Panel had with officers and others concerned. The Buildings Projects Team was fully associated with the work of the Panel and the members of the Team and the Secretary, C.O.P.P. accompanied the Panel in some of its visits.

The recommendations contained in the report have been accepted by the Ministry of Health and by the Planning Commission. Even during the process of evaluation, the Panel had made certain interim recommendations for economy on some specific projects, which, I am glad to say, have been accepted and put into effect. I hope the observations and recommendations contained in the report will lead to greater economy and efficiency in the planning and execution of water supply and sanitation schemes.

I take this opportunity of thanking the authorities in State Governments for their co-operation in supplying information required by the Panel and the facilities afforded by them for on the spot studies and discussions. I am extremely thankful to Shri N. V. Modak, Chairman of the Panel and his colleagues for the active interest they have shown and the trouble they have taken in preparing this comprehensive report.

Yours sincerely,

S. K. PATIL

Shri Govind Ballabh Pant,
Chairman, Committee on Plan Projects and
Minister for Home Affairs,
New Delhi.

REPORT ON NATIONAL WATER SUPPLY AND SANITATION SCHEMES

CONTENTS

Page

Report

Introduction i

1. The panel and its work 1

2. A survey of the situation 3

3. An analysis of the problem 7

4. The magnitude of the problem ahead 14

5. Measures for immediate implementation 16

6. Long Range Reforms 28

7. Rural Water Supply and Sanitation 35

8. Summary of Important Recommendations 42

Appendices

I. List of works visited and the persons with whom the Panel had discussions 45

II. Review of Important Schemes 49

III. National Water Supply and Sanitation Programme (urban and rural)—Expenditure schedule 62

IV. Flow Charts of Schemes 65

V. Extract from Proceedings of the First Public Health Engineers' Conference, September, 1955 71

सत्यमेव जयते

INTRODUCTION

0.1. The provision of safe and adequate water supply and hygienic disposal of wastes is a basic necessity for the healthy living of the community. Its importance is self evident and requires no emphasis. The urgency for water supply and sanitation measures assumes special importance in a tropical country like India, which is subject to periodic waves of water and filth-borne epidemics.

0.2. The science of environmental hygiene is of recent origin. It gained importance with the shifting of the emphasis from the curative to the preventive aspects of Public Health. This again, was a result of the growing industrialisation and urbanisation in the more advanced countries in the West which pinpointed problems relating to environmental hygiene as demanding immediate attention for the healthy living of the community. Public Health Engineering accordingly came to be realised as a specialised subject, including in its purview all essential activities bearing on the environment of man viz., town and village planning; housing—rural, urban and industrial; safe water supply; collection and disposal of community wastes; prevention of river, beach and air pollution; control of industrial and trade wastes; food sanitation, radiological health etc.

0.3. The preventive approach to secure environmental hygiene was relegated to the background in India until recent years. It was only after the advent of Independence that the Environmental Hygiene Committee in 1949, pinpointed attention to this all important subject and urged greater activity in this direction. They recommended a comprehensive Plan to provide water supply and sanitation facilities for 90% of the population within a period of 40 years and also suggested a scheme of priorities for certain areas. The provision for water supply and sanitation projects was later included by the State Governments as part of their planned development. Some headway was then made by the different States in this direction depending on their financial capacity to promote such a programme. But the progress made was halting and *spasmodic*. It was, in any case, totally inadequate with reference to the overall needs of the situation. Most often, the entire problem floundered on the inability of the States to find the requisite finances even for the limited programme they aimed at. The States were obviously unable to cope with the situation.

0.4. It was at this juncture that the Central Ministry of Health announced their National Water Supply and Sanitation Programme in the latter part of 1954. The object of the Programme was to assist the States in the implementation of their urban and rural schemes and to channelise their activities in a planned direction. Under the Programme, the State Governments were given a loan assistance for their urban schemes and a 50% grant-in-aid towards their rural schemes. The Programme was to continue as an integral part of the First, Second and successive Five Year Plans. The provision made against this Programme forms a sizeable proportion of the total provision made towards Health Schemes under the Plan.

0.5. A total sum of Rs. 18.75 crores was provided in the First Plan for the purpose—Rs. 12.75 crores for urban and Rs. 6.0 crores for the rural schemes. The corresponding expenditure however, was Rs. 8.20 crores and Rs. 2.80 crores only. In the Second Plan, the provision was increased to Rs. 91 crores—Rs. 63 crores for urban and corporation schemes and Rs. 28 crores for rural schemes, in the belief that the tempo of work would increase considerably. This expectation also did not materialise. The provision was later reduced to Rs. 55 crores. The probable expenditure upto 31.3.60 was Rs. 40.32 crores for urban and Rs. 18.14 crores for rural schemes.

0.6. The programme was obviously falling behind expectations. It was therefore considered necessary to find out the reasons for the slow progress and suggest measures for the speedy, effective and economical implementation of programme. The Committee on Plan Projects, whose function is "to help in the effective and economical implementation of the projects included in the Plan", accordingly, in December '58 set up, in consultation with the Ministry of Health, a Panel of experts to study the problem in detail and make suitable recommendations.

सत्यमेव जयते

1. THE PANEL AND ITS WORK

1.1. The composition of the Panel is as follows:—

Shri N. V. Modak, Director, Central Public Health Engineering Research Institute, Nagpur.	*Chairman*
Shri P. C. Bose, Chief Engineer, Public Health Engineering, Government of West Bengal, Calcutta.	*Member*
Shri R. D. Varma, Chief Engineer, Local-Self Govt. Engineering Deptt., Uttar Pradesh.	*Member*
Shri S. Rajagopalan, Assistant Director General (P.H.E.), Ministry of Health, New Delhi.	*Member*
Shri T. S. Vedagiri, Superintending Engineer and Secretary, Buildings Projects Team, New Delhi.	*Member-Secretary.*

1.2. The Panel had its first meeting in Delhi to chalk out their programme of work. This meeting was attended by the Secretary, Committee on Plan Projects and Members of the Buildings Projects Team. The Panel met nine times subsequently and examined in detail typical urban and rural schemes in the States of U.P., Bombay, Mysore, West Bengal, Punjab, Andhra Pradesh, Madras, Kerala and Bihar. The members of the Panel had free discussions with the different engineering officers of the States visited, on the techniques adopted for investigation and design, the constructional details followed during execution and the problems relating to the operation and maintenance of completed installations.

1.3. Details relating to the organisational set-up, the problems of training of personnel and service conditions obtaining in the different States, were also studied during the visits. The Panel made it a point to discuss these and the problems relating thereto, with the State administrative officers, Secretaries to Government, Ministers-in-charge of the Departments concerned, and the Chief Ministers. These discussions proved to be invaluable to the Panel in understanding the local factors bearing on the problem and the view held by those in authority in the different States on important issues like administration, financing and procedure, connected with the "Programme".

1.4. During the final phase of its work, the Panel had the opportunity of having joint visits and discussions with the T.C.M. Team of Public Health Engineers invited by the Union Ministry of Health to report on the National Water Supply & Sanitation Programme. The Panel had fruitful exchange of views with the Members of the T.C.M. Team.

1.5. A detailed statement of the Panel's itinerary, in each of the States visited and the persons with whom the Panel had discussions is given in Appendix I. A summary of the critical study of some of the important schemes examined is given in Appendix II.

1.6. The Panel is extremely thankful to the Secretary, Committee on Plan Projects for his active participation in its deliberations. The Panel also records its grateful thanks to all the authorities in the States visited, for the facilities offered for local inspections and discussions and for their willing co-operation and assistance.

सत्यमेव जयते

2. A SURVEY OF THE SITUATION

2.1. General Background

2.1.1. According to the 1951 census, India's urban and rural population were in the ratio of 17 to 83. The urban population lived in 73 cities with a population over one lakh, 485 towns with a population between 20,000 to one lakh, and 1448 minor towns with population range of 5,000 to 20,000. The rural population lived in some 5,85,000 villages, each village comprising several hamlets in many cases.

2.1.2. There is a paucity of authoritative data on which one could attempt an assessment of the urban and rural population which enjoy water supply and sanitation facilities. The Environmental Hygiene Committee in 1949 estimated that roughly 16% of the urban towns in India had water supplies which served 6.15% of the total population or 48.5% of the urban population. The supplies were designed to give 2 to 40 gallons per head per day. Only 23 cities and 12 other towns were partially sewered. In most of the sewered towns, however, 33% to 70% of the total number of premises were served by "conservancy". The position in regard to safe drinking water supply facilities in the villages could not be assessed by the Committee even approximately.

2.1.3. Although a decade has passed since then, conditions do not seem to have changed significantly. There has been a steady pressure of urbanisation during the past 10 years and many of the existing water supply and sewerage systems are getting more and more inadequate to meet the increasing demands. A number of agencies have been engaged in providing rural water supply and sanitation facilities but a correct measure of physical achievements effected so far is yet to be assessed.

सत्यमेव जयते

2.2. Progress in the Second Five Year Plan

2.2.1. The National Water Supply and Sanitation Programme under the First and Second Five Year Plans is the first organised attempt in this direction. The Statement in Appendix III shows at a glance the break-up of the figures relating to the expenditure programme on urban and rural schemes in the several States. The number of schemes approved, their original and revised costs, expenditure up to 31.12.59 and probable expenditure for the remaining period of the plan, and the amount of spill-over into the Third Plan, are also indicated in the Statement.

2.2.2. Based on the provision of Rs. 63 crores for urban schemes and Rs. 28 crores for rural schemes, the yearly expenditure under the Second Plan should have been of the order of Rs. 12 crores on urban and Rs. 6 crores on rural schemes. But the actual sanctions for urban schemes have been only Rs. 3.69 crores for the first year, Rs. 9.57 crores for the second year, Rs. 8.99 crores for the third year, and Rs. 11.24

crores for the fourth year of the Second Plan. The corresponding figures for the rural schemes were Rs. 0.95 lakhs, Rs. 1.75 crores, Rs. 2.35 crores and Rs. 2.05 crores. The provision made for the final year of the Second Plan is Rs. 13.39 crores for the urban and Rs. 1.465 crores for the rural schemes.

2.2.3. It will be observed that the incidence of the work-load in the actual implementation of the programme has been neither progressive nor proportional to the total provision in the Plan.

2.2.4. Many of the States are still engaged in implementing the spill-over schemes from the First Plan. They are permitted to take up new schemes, only if the spill-over schemes get considerably reduced.

2.2.5. In all, 291 urban schemes (229 water supply and 62 sanitation schemes) at a total estimated cost of Rs. 61.5 crores were approved during the First Plan. The spill-over value of these schemes carried into the Second Plan was about Rs. 51.2 crores as originally estimated and Rs. 59.42 crores as revised. Only 34 new schemes have been approved during the Second Plan at an estimated cost of Rs. 6.32 crores. The States are coming up with requests for approval to new schemes in a greater and greater measure. The approval to these new schemes, however, has been made in many cases on condition that the State Government do not require any foreign exchange for implementing them during the Second Plan.

2.2.6. On the rural side, 133 schemes estimated to cost Rs. 13.5 crores were approved during the First Plan period and grants-in-aid totalling to Rs. 2.8 crores were paid. Most of these schemes were continued in the Second Plan and are nearing completion. The Second Plan included a provision of Rs. 28 crores for the rural phase of the National Water Supply & Sanitation Programme. So far 291 schemes (including those approved in the First Plan) estimated to cost Rs. 18.4 crores have been approved, and grants-in-aid totalling to Rs. 8.8 crores have been paid. These schemes cover some 15,000 villages and the population benefited would be roughly 16 million.

2.3. The Procedure in Vogue

2.3.1. The procedure at present is for the State Governments to get the technical details of their schemes prepared by their Public Health Engineering Organisations and to send them up for scrutiny and approval to the Union Health Ministry. The Ministry is assisted by the C.P.H.E.O. (under the control of the D.G.H.S.) in administering the programme. Financial allocations are made to the State Governments against their expenditure figures from time to time. The State Governments are expected to intimate to the Central Government the progress of the schemes through periodical Progress Reports prescribed for the purpose by the Central Health Ministry and the Planning Commission.

2.3.2. When the programme was announced towards the close of the First Plan period, the States sent up quite a number of urban schemes already in different stages of progress for getting financial aid to accelerate their progress. All these schemes continued into the Second Plan period as spill-over schemes. The directive of the Planning Commission that the spill-over schemes should be mostly completed before new schemes could be undertaken appears to have acted as a handicap to many of the States. Besides, such a procedure had not been indicated to the States when schemes were included in the First Plan. Most of the State Public Health Engineers on the other hand desire to have a large number of sanctioned schemes on which they could spread out the expenditure and utilise the allotments in full. The issue is still to be settled satisfactorily.

2.3.3. Again, the State Public Health Engineers are unable to undertake investigation and design of schemes until the local bodies deposit centage charges in advance. This usually takes a long time. In some cases the local bodies are unable to provide the requisite funds and even where funds are provided, work is delayed for want of adequate investigation staff with the State Public Health Engineering Department.

2.3.4. It is also learnt that during the First Plan period, schemes in large numbers were formulated and simultaneously sent to the Health Ministry by the States. Because of the urgency and inadequacy of technical staff for scrutiny, the Ministry had to sanction nearly 250 urban schemes and 133 rural schemes to enable the States to incur expenditure upto the promised allotments within the First Plan period. At the time of communicating such sanctions to the schemes, the State Governments were requested to furnish further details of their schemes in due course. The Panel understandings, however, that many of the States proceeded to operate on this general sanction and submitted the details of schemes after a considerable time. The C.P.H.E.O. as a complete entity started functioning since March-April 1957 by which time many of the States had gone ahead with their schemes. Subsequent scrutiny of such schemes and on-the-spot inspections by the C.P.H.E.O. have brought out several technical deficiencies in their planning and execution.

2.4. Existing Organisation Set-up in the States

2.4.1. The Public Health Engineering set-up in the different States does not follow any uniform pattern. West Bengal, Bihar, Uttar Pradesh, Punjab and Kerala Governments have an independent Public Health Engineering Department. Andhra Pradesh, Madhya Pradesh, Rajasthan and Orissa have recently set up Public Health Engineering Organisations, but a separate cadre therefor is yet to be built up. Madras and Bombay have a separate Public Health Engineering unit working under the control of the Public Works Department. While the cadre is common with Public Works Department in the case of Madras, there is a separate cadre for Public Health Engineering in Bombay. Mysore had also a separate but dependent Bureau for Public Health Engineering but it had recently been integrated with the Public Works Department. Assam has a small but independent nucleus of Public Health Engineering staff; Himachal Pradesh and Jammu & Kashmir are yet to build up one.

2.5. Financial Allotment

2.5.1.. Though the total provision in the Second Plan for National Water Supply & Sanitation Schemes indicates the size of the workloads for the States during the plan period, the actual allotment to each State is made from year to year, the quantum for each year being decided on the budgetary exigencies of the Central and State Governments after joint discussions amongst the representatives of the Planning Commission, the State Government concerned and the Central Health Ministry.

The final allocation, however, is made by the Central Finance Ministry and intimation thereof is given to the State Governments most often after the commencement of the financial year to which the budget relates. It is learnt that recently the Central Government have permitted the State Governments to draw from the yearly allocations, proportionate funds for the first nine months of the year, leaving the final adjustments to be made in the last quarter based on the actual expenditure incurred.

सत्यमेव जयते

3. AN ANALYSIS OF THE PROBLEM

3.1. It is proposed to discuss in this chapter the procedural, organisational and financial handicaps which impede the progress of the Programme at present.

3.2. Uncertainty in Financial Allotment

3.2.1. By far the most serious factor impeding the progress of the Programme is the existing method of financial allocation on a year-to-year basis and the belated intimation given to the State Government. Water Supply and sanitation schemes call for long range planning and advance indenting for materials. Proprietary articles like pump sets, water and sewage treatment plants, Cast Iron pipes and specials and similar appurtenances take a long time to procure under present conditions. The main bottle-neck particularly relates to Cast Iron pipes and specials, as their supply is far short of the demand. There is therefore, a long time-lag in between the placement of an order for these materials and their actual delivery. C. I. pipes particularly take about 2 to 3 years for procurement. Further, under the present financial regulations, the State engineering authority cannot place orders for these materials until the schemes have been specifically sanctioned and funds provided. Besides, State Governments cannot provide funds for the schemes unless the Centre has made definite allocations. As allocations for each year are intimated after the commencement of the year, the State Engineering authority can do very little to procure the required proprietary materials before the end of the year and utilise the allotted funds. This results in upsetting the progress of work on each scheme year after year. It would be obvious from the above that the State engineering authority is unable to do any advance planning and achieve concrete results on the face of such uncertainty of yearly allotments. This also prevents advance action being taken in regard to land acquisition and other procedural measures involving financial commitment.

3.3. Procedural Handicaps

3.3.1. The procedural steps to be followed from the initiation of a scheme upto its completion are many and time-consuming. Urban water supply and sanitation schemes are primarily the concern of the local bodies. The State Government is at best acting as a liaison between the local bodies and the Central Government in their implementation. It requires a certain amount of prompting, guidance and advice from the State Government to the local bodies before a scheme can be initiated. The preliminary work involved in initiating a scheme and getting the local bodies to move in the matter also falls on the Public Health Engineering Agency and the State Government's administrative machinery. The financial aid given by the Centre is only by way of loan. Eventually, the local body has to repay it, except in regard to such portion of it as may be subsidised by the State Government. It becomes necessary therefore, to assess the capacity of the local body to repay the loan and obtain its concurrence to the levy of necessary additional taxes, and for sale of water at appropriate rates, before any work on the scheme can be proceeded with. This process takes a considerable length of time, sometimes running into years.

3.3.2. The State Governments are required to send schemes in a fairly detailed shape to the Health Ministry at the Centre for approval. This cannot, however, be done without thorough investigation and detailed design. The State Governments are not in a position to order such detailed preparation of schemes, before the preliminaries are settled with the local bodies involving all the time-consuming procedures indicated above.

3.3.3. Even after the necessary preliminaries have been settled with the local bodies concerned, the actual investigation, design and preparation of the concerned scheme and its processing through State and Central Governmental agencies entail an unduly long period of time under the existing procedure. Apart from the long delays involved on the administrative side, scrutiny and approval by the various engineering agencies in the States and at the Centre cause a certain amount of unavoidable delay. In several cases this is also due to the defects and deficiencies in the preparation of the technical details of the schemes, partly because of lack of uniformity in design standards.

3.3.4. Even when schemes reach the stage of execution, further delays occur which could be avoided by proper planning. Most often protracted land acquisition proceedings hold up the progress of work. More essentially, want of scarce materials like C. I. pipes and similar equipment hold up the progress indefinitely. As already explained, advance procurement of such materials is not possible under the existing method of financial allocations. It is not seldom that due to defective or hurried investigation and planning, a scheme calls for revision of essential details during the various stages of its execution, involving further delays in its progress. Delays are also caused in getting permission from competent authorities, when water supply and drainage lines have to be taken through properties belonging to other departments. This is essentially due to lack of effective co-ordination.

3.3.5. An unusual feature noticed by the Panel was that even after the completion of a scheme, delays are allowed to occur in bringing it into beneficial commission. In a number of rural schemes examined by the Panel, it was strange to notice that procedural and financial arrangements for taking over and maintaining the schemes were not settled with the local bodies for a long time after their physical completion.

3.3.6. Flow sheets of a few typical schemes studied by the Panel are given in appendix IV which illustrate the points mentioned above.

3.4. Organisational Drawbacks

3.4.1. The programme also suffers from organisational drawbacks at the State level. To a certain extent, they are attributable to the existing method of financing. Because of the meagre and indefinite financial allotments made from year to year, a few of the State Governments do not seem to attach any major importance to the organisational needs for implementing the Programme. They consider that for the indefinite and comparatively small work-loads handled by them, the setting up of a separate Public Health Engineering Department is neither necessary nor economical and are therefore content to entrust these duties to the P.W.D.

3.5. **Lack of Trained Personnel**

3.5.1. Due to the lack of recognition of Public Health Engineering as a separate and specialised science in the country as a whole, engineering graduates are disinclined to take to Public Health Engineering as a career. This has resulted in a dearth of trained Public Health Engineering personnel in the country. This again is reflected in the indifferent quality of the schemes drawn up by some of the States in respect of technical details.

3.5.2. The Panel, is, however, happy to note that the measure of scrutiny exercised by the Health Ministry through the C.P.H.E.O. has created a growing awareness on the part of many of the States that their projects should be drawn up with fuller details and greater circumspection to secure the approval of the Central Health Ministry. It has impelled the State Governments to depute candidates from their engineering services to undergo post-graduate and short-term courses in Public Health Engineering.

3.6. **Multiplicity of Agencies**

3.6.1. Urban water supply and sanitation schemes are the concern of local bodies but most of them depend on the State Engineering Departments to design and execute their schemes before they are handed over to them for maintenance. Such of the States which have a self-contained Public Health Engineering Department carry out the investigation, design and execution of the schemes in an integrated manner and also exercise periodical supervision on the maintenance thereof. In those States where there is no unitary Public Health Engineering Department, the investigation and design work is carried out by one unit, execution by another unit while the maintenance devolves on the local bodies. This leads to divided responsibility and detracts from the efficiency of the schemes as a whole.

3.6.2. A number of agencies are in charge of rural water supply schemes. The National Water Supply Programme under the Health Ministry, the programme of the Community Development Department, Tribal Welfare Schemes under the Home Ministry and the Local Development works are implemented through a number of State Departments. Most often, the field agencies in charge of the Programme are executing the rural schemes without adequate and competent technical personnel. The proper location and development of sources go by default in many cases. Not only is there a poor return for the money spent but also the Public Health measures for ensuring the safety of the supply are most often over-looked. Because of the multiplicity of agencies engaged on this Programme and lack of unitary control in its implementation, it is not possible to make any correct assessment of the physical achievements made under the Programme.

3.7. **Lack of Standards**

3.7.1. There is a large diversity in procedure, practice and technique as between State and State in regard to the preparation of plans and estimates. The Public Health Engineering profession in the country is still in its infancy. Uniform standards and specifications are yet to be laid down. There is a divergence in practice even in regard to the use of basic materials for conveyance of water and sewage. The design criteria for water treatment plants, pumping plant capacities, conveying mains, distribution systems, service reservoirs and the like vary from place to place. Similarly, sewers, sewer appurtenances and sewage treatment plants are designed on different assumptions in different places. More often than not, there is a tendency to depend on the equipment suppliers for the lay out, design, construction and maintenance of such projects. The implication of such a procedure will be obvious particularly when no standard practice and specifications have been laid down in this behalf for uniform adoption.

3.8. **Technical Deficiencies**

3.8.1. In the course of its study of a number of schemes in the various States, the Panel came across instances where the cost of schemes had gone up due to inadequate investigation, unrealistic design standards, injudicious phasing of works, inadequate attention to hydraulic details and lavishness in the design of structures. A few instances may be cited here.

3.8.2. **Defective Investigation and Planning**

3.8.2.1. A river subject to tidal influence was selected as the source for a major composite water supply scheme estimated to cost Rs. 92 lakhs. The investigation did not include any examination to ensure that the location of the head works would be beyond the range of tidal influence at any future date. At the site selected the river also carried a heavy pollutional organic load. The physical and chemical characteristics of the raw water had not been properly examined. For a scheme of this magnitude the investigation for the location of the source should have been carried out with greater circumspection.

3.8.2.2. In the case of another major town, an existing source which had served satisfactorily for more than four decades was abandoned in favour of a new and distant source for no valid reason. A part of the pumping main from the old source was also removed rendering the source incapable of being used even in an emergency. Subsequently, it was decided to retain the old source as well and a new pipeline laid for the purpose.

3.8.2.3. A comprehensive water supply improvement scheme had been completed for another important town at a cost of Rs. 1.3 crores where a long C. I. pumping main was provided on the assumption that the source should yield a daily supply of 4.2 million gallon. On the completion of the work, the potentialities of the source were far below expectation and the actual yield of the source as developed is reported to vary from 0.8 to 1.8 million gallons per day. Additional sources are under investigation. The large investment made on the conveying pipe lines has therefore been rendered partly idle all the time.

3.8.2.4. There was a similar instance where a source expected to yield 2.5 million gallons per day was found to yield only 0.2 million gallons on the completion of the scheme. The other components, however, had been designed and constructed for the full capacity of 2.5 million gallons involving idle investment of huge capital. Other sources have to be explored to supplement the supply.

3.8.2.5. To develop a supply from a river bed to serve a major municipal town, a filter basin had been laid out over an area of 200'x100' without any investigated data regarding the subsoil layers and the range of scour. The layout of the infiltration works did not conform to any rational pattern. The yield from the completed unit was not assessed for two seasons after its execution. No data had been collected even about the minimum surface flow available in the river. The work had been completed on some ad hoc assumptions. The original estimate included, strangely enough, provision for a surface treatment plant, should the infiltration works fail to yield the expected quantity. Meanwhile the other components of the scheme such as the conveying main, service reservoir, distribution system etc. had been mostly completed. At this advanced stage the capacity of the source and the method of developing the supply therefrom was being reinvestigated. Surely, this is a defective method of planning and executing a major scheme of this nature.

3.8.3. Deficiencies in Design

3.8.3.1. A per capita supply varying from 10 gallons to 50 gallons per day is being assumed in the preparation of urban water supply schemes, the figures varying from State to State. In many cases, sufficient note is not taken of the fact that a part of the population served cannot and does not take house connections, and draws its requirements from public stand-posts only. The total capacity of the schemes is usually based on a future population drawing the supply at the assumed per capita rate uniformly. This tends to push up the cost of the scheme on components which are over sized for the actual requirements now and for several years hence. A greater attention is called for in order to limit the size of the schemes to the paying capacity of the consumers with provision for a progressive expansion in successive stages, to suit the increasing demand so that the financing of the scheme may be made more viable.

3.8.3.2. In regard to rural water supply schemes, the per capita supply varies from 5 to 15 gallons per day. The Panel did not come across any arrangement for the disposal of waste water. A rural water supply differs from an urban one in that the villagers are expected to draw normally from public stand-posts only. The Panel considers that rural schemes drawn up on the basis of 10 or 15 gallons per capita are extravagant particularly when the cost of the schemes is subsidised by the Centre and the State Governments. It is not realistic to expect that the consumers would draw and convey a 15-gallon supply per capita from stand-posts to their houses. In addition, it will also aggravate the concurrent problems of the collection and disposal of the waste water.

3.8.3.3. In one State, rural water supply schemes provide not only a 10-gallon supply for the human population but also for the entire cattle population, present and prospective. The provision of protected water for cattle is, to say the least, extravagant.

The cost of such schemes was found to vary from Rs. 80 to Rs. 100 including human and cattle population alike. An investment of Rs. 100/- to provide protected water supply for each head of cattle is an extraordinary procedure. It should be possible to provide for cattle from existing local sources.

3.8.3.4. In regard to the design of water and sewage treatment plants there appeared to be a general tendency to rely on the recommendations of the particular manufacturer selected. This has resulted in glaring disparities in the design factors for essential components. Flocculation does not receive adequate attention in some cases. Settling basins are not properly designed. Waste water launder arrangements for filter beds are most often defective resulting in avoidable waste of wash water and inefficiency in filter operation. Routine tests necessary for the control of the plants are not provided for and go by default. Some times, adequate and satisfactory guarantees for the proper performance of the plant are not obtained.

3.8.4. Injudicious Phasing of Works

3.8.4.1. The Panel has come across several instances where the components of major water supply schemes in progress had not been phased out so that the schemes could yield benefit to the consumers both at an intermediate stage and at the final stage of completion. Storage capacities at head-works are expanded without corresponding increase in the treatment plant or in the conveying main or in the distribution systems. By not synchronising the work on the different components, the expenditure incurred at each stage remains idle until the scheme gets completed as a whole over a long period. Long lines of pumping mains of big sizes were completed in a hurry while distribution systems were not simultaneously expanded to receive and distribute the additional supplies. In certain cases it was understood that the distribution systems were left to the individual municipalities for necessary remodelling in their own time while improvements to the source and conveying mains were carried out in a hurry by the State engineering agencies. These are cases of irrational planning and uneconomical phasing of expenditure. It invariably results in the investor not getting full value out of the appreciable investment made on such schemes.

3.8.4.2. Yet another distressing instance was seen in the case of a major municipality where a complete sewage treatment plant at a cost of Rs. 8.5 lacs was installed without even taking up the investigation for the sewerage system for the town. A firm of equipment manufacturers had provided clarifiers, mechanical aeration tanks, sludge digestors and drying beds. The components contain considerable structural steel work and other equipment which require careful operation and vigilant up-keep and maintenance. Only after the completion of this installation, was the field investigation taken up for the sewer system. It was understood that it might take not less than five years before any sewage can be brought to the treatment plant. Meanwhile it will be difficult and costly to maintain the idle units and prevent their deterioration. One fails to see any logic or wisdom behind such planning.

As an after-thought, one of the digestion tanks was being used to deal with night soil from the town. This has necessitated the provision of yet another structure at some additional cost. Even so, in the absence of laboratory facilities for necessary daily tests the successful operation of the digestion tank is handicapped.

3.8.5. Maintenance of Schemes

3.8.5.1. The Panel was distressed to know that as a rule the maintenance of completed schemes of water supply and sewerage system left very much to be desired. In water treatment plants installed at considerable costs pre-conditioning units were not operated intelligently and economically. Systematic laboratory analysis which should form part of such maintenance was found wanting. The running and control of the filter plants and a careful check and logging of the daily results were not done in any systematic way. Most of these defects were attributable to the absence of qualified operators, properly trained for their work.

3.8.5.2. The question of proper maintenance of costly sewage treatment plants is of even greater importance as we are yet to develop new techniques suited to conditions in this country in the design, construction and maintenance of such plants for the urban areas. Unfortunately, the bringing up of a category of competent and trained operators has not received the consideration it deserves, from the State Governments and the local bodies. This aspect of the problem demands immediate attention.

3.8.5.3. Another town had recently completed the installation of a modern sewage treatment plant at a cost of about Rs. 7½ lakhs to deal with a part of the town's 'sewage' but its beneficial utilisation is being delayed due to the absence of competent staff to run and maintain it and to lack of provision of laboratory facilities as part of the installation. The plant does not also seem to form a part of any comprehensive scheme for the entire town as no such scheme has been prepared.

3.8.5.4. As part of the sewage treatment plant, a major corporation had installed clariflocculators with a capacity of 16 mgd some 8 years back. The plant, however, was not put into operation ever since, as the concurrent question of sludge digestion was under some controversy. Throughout this period, investment on the plant was idle and the benefit of treating the sewage was lost to the corporation.

3.8.6. **Uneconomical Design of Structures**

3.8.6.1. The Panel noticed a wide disparity in standards and specifications adopted for structures. In many cases the area of the pump house could be considerably reduced if the pump sets were staggered. In one case, the width of the pump house had been increased in order to get access to the pipe gallery below through an open staircase whereas a manhole and a ladder could have served the purpose without extra width.

3.8.6.2. In the case of a filter house, the wall thickness as provided was excessive, spacing of roof trusses was uneconomical and the span of the roof truss was unduly long resulting in the use of heavy steel work. It could have been far cheaper and more elegant to have reduced the span with an intermediate row of columns.

3.8.6.3. In many cases filter house layouts included unnecessary and non-functional floor areas adding to the cost.

3.8.7. The Panel must, however, record that they did come across schemes which bore the stamp of careful planning, diligent designing and competent execution. Even in these cases, the maintenance phase of the scheme did not receive the same degree of importance from the local bodies who are in charge of their daily operation, maintenance and management.

4. THE MAGNITUDE OF THE PROBLEM AHEAD

4.1. It is relevant in this context to evaluate the magnitude of the problem which lies ahead. Unfortunately, correct statistical data is lacking in regard to the existing water supply and sanitation facilities in urban and rural areas in the country. According to the 1951 census, 6.2 crore people lived in urban areas while some 30 crores lived in the rural areas. From the meagre data available, it may be assumed that about 50% of the urban areas lack protected water supply while over 85% lack the amenity of a sewerage system. Even in those urban areas where water supply or sewerage facilities do exist, they are inadequate and are in need of substantial additions and improvements.

4.2. Assuming the average per capita cost of an urban scheme at about Rs. 50|- for water supply and Rs. 70|- for sewerage, the financial outlay necessary to complete water supply and sewerage schemes for the urban population lacking these facilities at present, would be of the order of Rs. 600|- crores. If additions and improvements to the existing facilities are also to be taken into account, the total figure may be about Rs. 900|- crores.

4.3. As for the rural areas, very little headway has been made so far. Only about 15,000 out of the 5.85 lakhs of villages figure in the National Water Supply and Sanitation Programme. Some progress has been made under the other programmes but no correct measure of the quantum of work done is available. It has been estimated that the cost of providing water supply and sanitation facilities for rural India may amount to about Rs. 600 crores. This may be placed at Rs. 300 crores if only minimum facilities are aimed at in the first instance.

4.4. With such a workload ahead and at the present rate of expenditure of Rs. 60 to 100 crores for each Five Year Plan it would take more than half a century for the present urban population to secure these facilities. If the increase in population during this period is taken into account, as it should be, it would take a few more decades to achieve the target.

4.5. There is yet another important point to consider. The figures indicated above do not constitute a non-repetitive or a self-closing commitment. The expenditure on water supply and drainage schemes is a recurring commitment in that schemes designed and completed to suit specific areas and to serve prospective populations upto a particular period will have to be altered, augmented and renewed, from time to time to cope with increased demand. Local Bodies therefore, will not only have to operate and maintain completed installations but also have to invest additional capital periodically, for improving and expanding them. The work load for a local body in installing a water supply and sewerage scheme initially, and in improving and expanding it periodically thus imposes a continuing financial commitment against capital and recurring costs.

4.6. Rural water supply and sanitation schemes stand on an entirely different footing. They are at present being subsidised by the State and Central Governments, the villager paying a fraction of the cost as an earnest of his desire to have this essential amenity. The maintenance of the scheme is left to the villagers, but in many cases they do not seem to be prepared to shoulder even this burden. The future pace of progress in the field of rural water supply and sanitation would be dictated by the willingness and capacity of the villager to pay for the installation and maintenance of those facilities.

4.7. This, then gives a broad idea of the work ahead and its magnitude. The Developmental Plans of the country will call for a decision in regard to the period within which the urban and rural phases of the programme should be covered. The Third Public Health Engineers' Conference held in October, 1958, recommended that the urban part of the Programme may be completed within the next 25 years, and the rural part in a shorter period, say, 15 years. This will involve an annual outlay of Rs. 36 crores on urban and Rs. 20 crores on rural schemes, which by itself will impose a heavy financial burden on the community. Setting a shorter period for accomplishment, would result in much greater strain on the financial resources of the country. On the other hand, extension of the period might hamper the progress of the Nation in all other fields of activity.

4.8. It has been recognised that the high incidence of water and filth-borne diseases in the country are due to lack of adequate and protected water supply and sanitation facilities. Periodic waves of these epidemics, not only take a heavy toll of life, but also leave in their wake a high morbidity and low vitality amongst large sections of the population, lowering thereby their productive capacity. It is, therefore, essential for the Government to decide as to the period within which both the phases of the programme should be covered and to take action for its implementation accordingly. The Panel would endorse in this connection, the views expressed at the third Public Health Engineers' Conference in this behalf.

4.9. A programme conceived on the above lines would require major policy decisions for its implementation. Until this is done, it will be necessary to continue work on the Programme under the present limitations as best as possible.

सत्यमेव जयते

5. MEASURES FOR IMMEDIATE IMPLEMENTATION

5.1. The immediate methods considered necessary to expedite the Programme under the existing set up are outlined in this chapter while the major reforms of a more radical character will be dealt with in the subsequent chapter.

5.2. Change in the Policy of Financial Allotment

5.2.1. It has been explained before that the planning is based on a 5 year term, while the financing is on a year to year basis. Besides, the procedure adopted results in a belated information to the State Governments regarding available funds for any year. This leaves the state public health engineering authority very little time to plan for the projects, procedure materials and incur the expenditure. In fact the workload for the year is restricted to the extent of planning possible on their part and the actual quantity of materials they could procure within a restricted period. Most of the state public health engineers feel that they could handle a much larger workload, if they had advance information about specific allotment forthcoming for each year as they could then be ready with a larger number of approved projects and also place advance indents for materials required. In effect, therefore, the allotments at present are made to depend on the limitation on the spending capacity of the State Departments imposed by the existing procedural drawbacks while normally such allotments should be based on their optimum spending capacity in the absence of such handicaps.

5.2.2. It has also been explained earlier that there is at present an acute shortage of proprietary materials required for water supply and sanitation projects resulting in a long time-lag between order and delivery. The position is specially acute in regard to C.I. pipes and specials. To get over this difficulty, many of the States have taken to stock-piling of C.I. pipes and specials from which they divert required quantities to the projects taken on hand as and when financial allotments are made by the Centre. With an overall shortage of materials in the market, an initial stock-piling is necessary in order to get over the time-lag and commence the execution of projects with allotted funds. Thereafter, advance indents should help in procuring the materials in time to be used straight on the projects, to be taken up. The extent of stock-piling would then be progressively reduced to the minimum necessary for meeting the uncertainties in the supply at any time. But many of the State Governments are building up a continuous reserve stock of pipes not only as a means of meeting the time-lag between order and delivery, but also as a possible remedy against the indefinite financial allotments made from year to year. Stock-piling can neither be a remedy against indefiniteness in financial allocations, nor against the time-lag between order and delivery so long as advance indents can be placed against specific schemes to be taken up. The Panel noticed that the extent of stock-piling with reference to the actual workload varied from State to State without any rational basis. This tendency to build up undue reserve stocks of critical materials like C.I. pipes and specials could be checked if the existing procedure for financial allotments is suitably modified.

5.2.3. The Panel has discussed the subject of financial allotment with many of the State P.H. Engineers, Administrators and Ministers. There is a consensus of opinion that the existing procedure of allocating funds on year to year basis acts as a self-imposed impediment to the progress of the Programme and that the only practical solution to speed it up would be to place the financing on a three or at least a two year basis. This would enable the Centre and the State Governments to take stock of the position two or three years in advance for any particular year of the Plan and announce the decision in regard to the available funds at least two years in advance of the financial year to which the allotment relates. It would help the State Government to Plan its programme and show better out-turn alround.

5.2.4. The method of budgeting on a three year basis, though attempted successfully in certain other countries, may perhaps be difficult of implementation in our country at the present juncture. This is mainly due to the paucity of resources and the fluctuations in the availability of foreign exchange. The Panel, however, does not see any other way of speeding up the progress of the National Water Supply and Sanitation Programme because of the peculiarity of the problem. The Panel cannot, therefore, help recommending the adoption of two or three year budgeting for this programme as a special case.

5.3. Change in the Procedural Set-up

5.3.1. The preparatory work required to be done before a scheme for water supply and sanitation is taken up for planning, as enumerated earlier, is prolonged and cumbersome. It should be possible for the State Governments to reduce to a minimum all procedural delays. In order to get over other time consuming but avoidable formalities, the States should fix up priorities for the various schemes and take up the preparatory work on them well in advance so that they may have a number of schemes on hand ready for implementation as and when opportunity arises. For this purpose, it is desirable that the State Governments set up a procedure which will facilitate field investigation and design of projects to be taken up in advance of the collection of the necessary centage charges from the concerned local bodies wherever such collection is likely to cause delay. It is equally essential for the State Governments to detail special staff for the advance investigation and preparation of projects.

5.3.2. It is hardly necessary for the Panel to suggest that the State Governments should take advance action in regard to land acquisition proceedings relating to their water supply and sanitation schemes so that there is no avoidable delay in the execution of the component works of the schemes. Such delays were noticed by the Panel during the study.

5.3.3. Similarly delay in getting permission from other authorities of the Government or statutory bodies to take pipe lines and sewers through their lands can be avoided through timely action and greater liaison among the various Departments.

5.3.4. It was reported that inter-State sales tax at the rate of 7% was charged from Corporations and other local bodies while the State Governments have to pay only 1% on their inter-State purchases. The Panel sees no justification for this difference in the levy of inter-State sales tax. Nearly two-third of the expenditure on water supply and sanitation scheme is on pipes which the local bodies and municipalities in most of the States have to purchase from outside their own States. The levy of a higher rate of sales tax would unnecessarily inflate the cost of water supply and sanitation schemes. This is an unnecessary hardship imposed on local bodies. The Panel would strongly recommend that this should be reconsidered by the Government and the disparity in the levy of sales tax removed.

5.4. **Speeding of Scrutiny at Different Levels**

5.4.1. The Panel has come across criticism from some of the States that the existing procedure for scrutiny and approval by the Central Health Ministry, of plans and estimates sent up by the States, causes considerable delay and duplication of work. Some entertained the opinion that such scrutiny by the Centre was not necessary as the State Public Health Engineering agency was, according to them, competent to design and execute the schemes without outside help. The Panel noticed that some of the States had proceeded with the execution of a number of schemes without submitting details thereof for approval by the Central Health Ministry.

5.4.2. After studying the details of the projects in progress in different States, the Panel is convinced that Scrutiny by the C.P.H.E.O. is necessary until independent P.H.E. Departments with trained and qualified staff get established in the States. Codes of Practice for the planning, execution, operation and maintenance of P.H.E. works, are framed and adopted and consulting P.H.E. Engineers start playing an effective role.

5.4.3. The Panel is anxious, however, that any delays which now occur in the process of submission of schemes and their approval by the Health Ministry should be reduced to the minimum, if not altogether avoided. Much of the delay was due to the concerned departments in the States submitting their Schemes without complete details and explanatory reports. The appendix V shows the special form in which details of the Schemes are to be submitted to the centre. This was formulated in the P.H.E. conference as early as September, 1955. The Panel, however, was informed that this form was not being adopted by many of the States resulting in revision of Schemes and consequent delay in their approval. The Panel would recommend that the concerned agency in the States should invariably furnish the details prescribed in the form to avoid unnecessary duplication of work and delay.

5.4.4. It would appear that after the technical scrutiny by the C.P.H.E.O., the Ministry of Health takes some time to accord administrative approval after consultation with the Finance Ministry and Planning Commission, where necessary. Here again, delays could be minimised if the authorities concerned furnish full and complete information in regard to the number of schemes in progress, the expected load of spillover schemes and similar details which the Health Ministry seem to require before they could accord final approval. The Panel, would however, suggest that the Health Ministry may explore ways and means of cutting short existing procedural delays and speeding up approval of schemes.

5.5. **Rationalisation of Centage Charges**

5.5.1. The scales of departmental charges levied by State Governments for investigation, design and execution of schemes for local bodies vary widely. The Panel cannot understand the rationale behind such a wide variation. It would recommend that an analytical study should be made of the actual expenditure incurred by the Government Departments on the various schemes planned and executed by them on behalf of local bodies so that such charges may be levied on rational lines. Obviously, the charges should be so adjusted that the Government does not make any profit.

5.5.2. It is quite likely that where local bodies begin to entrust their schemes to private Consulting Engineers in coming years, they may be able to get their work done at comparatively cheaper rates in a competitive field.

5.6. **Organisational Reform**

5.6.1. Some of the State Governments, as already pointed out have not set up a separate department for Public Health Engineering as they consider the work load does not warrant such a step. Some question the very need for a separate Public Health Engineering Department as they feel that the P.W.D. itself is competent to handle such works. The Panel need hardly labour the point that for the efficient and economic planning, design and execution of Water Supply and Sanitation Schemes specially trained and qualified personnel is a *sine qua non*. This is not possible unless a separate department is set up in each State which could attract and retain the pick of men. Admittedly, the volume of work yet to be done in this field is of great magnitude involving huge expenditure. Water Supply and Sanitation Projects for communities constitute a perpetual work load. It, therefore, becomes all the more important for State Governments to pay particular attention to this aspect and set up an independent department, where they have not done so. Any State which does not equip itself with a properly organised and competent department is bound to lag behind those which are better organised for the purpose.

सत्यमेव जयते

5.6.2. With the setting up of Public Health Engineering Department in each State, there is also the necessity of provincialising the cadre of municipal engineers and making it integral with the Public Health Engineering Department. This will ensure interchangeability and continuity of experience of personnel in all aspects of water supply and sanitation works. There is a growing tendency to divorce design from execution and operation. This is hardly conducive to the efficiency of the personnel or of plant operation. The panel has, therefore, to lay strong emphasis on the need for continuity of experience in the integrated field of design, execution and maintenance of works. This can be achieved only by setting up of a separate Public Health Engineering Department with the Municipal Engineering Service integrated as a part thereof.

5.7. **Training of Personnel**

5.7.1. The training of public health engineering personnel in an increasing measure in future years should also receive adequate attention. When all the States fall in line with the idea of creating and fostering a self-contained Public Health Engineering Department, they will need an increasing number of technical men in different categories. The facilities at present provided for Post-graduate Studies and for short-term courses in Public Health Engineering at Calcutta, Madras and Roorkee should suffice to meet the immediate needs. It may be necessary to augment the strength of those institutions as well as to start new ones at other regional centres, as and when the demand for training increases.

5.7.2. It is also desirable to arrange for refresher courses to the different grades of in-service-personnel at suitable centres in the States.

The Panel would here draw special attention to the fact that quite a large number of subordinate technical personnel are employed at the block level in the implementation of the National Water Supply and Sanitation Works under the C.D. and L.D. Programmes. It is essential to institute a training programme for all these personnel, to include short-term training courses and refresher courses as well as seminars at regional training centres where fundamental knowledge on the design and maintenance aspects of Public Health Engineering could be imparted to them. The Panel has elsewhere referred to the need for all such personnel working under the technical control of the P.H.E. Department of the State for securing better efficiency and co-ordination. The training in public health engineering as proposed above, will facilitate such an overall technical control.

5.7.3. The Panel would suggest the formation of a National Water and Sewage Works Association which could act as common forum for free exchange of ideas on the problems met with in the operation and maintenance of water treatment and sewage disposal works. Frequent seminars of different grades of operators could be profitably held in various regions. The Panel is confident that this step would go a long way in promoting free and faster exchange of ideas which could be of great help to the successful and economic operation and maintenance of costly plants.

5.7.4. The Health Ministry has been organising a conference of public health engineers for some years. So far three such conferences have been held. Such conferences have proved to be invaluable to Engineers in understanding the problems of one another and coming to fruitful conclusions on several issues which have a bearing on the successful implementation of the schemes conceived in the Plan. The Panel would recommend that the conference should be open to Public Health Engineers in the field of manufacture of equipments needed for water supply and sanitation projects, and also Public Health Engineers in contracting firms engaged on the execution of such works. An exhibition of different materials and equipment used for water supply and sanitation projects can also be profitably arranged at the time of the conference. The Panel would strongly recommend the holding of this conference more frequently, at least once a year.

5.7.5. With the increasing number of water supply and sewerage installations coming into existence there is an imperative need to train plant operators of different grades to take charge of the operation and maintenance of all such costly installations. It would also be necessary to standardise their qualifications and training to bring them under a National Certificate Scheme. The Ministry of Health should initiate the necessary measures in this behalf in consultation with State Governments.

5.8. Need for a Common Code of Practice

5.8.1. The Panel has elsewhere referred to the diversity of design criteria and standards now followed by different States. A common code of practice laying down standards and specifications for design and execution of Public Health Engineering Works in the country is now an imperative need. The lack of such a code is acting as a serious handicap to the progress of public health engineering. The Panel was concerned to note that several types of water treatment plants are being installed for a number of schemes under the Programme without any uniform or effective standards or specifications being laid down or enforced in regard to their operation and maintenance for satisfactory results. With an increasing tempo of work in the future years it is no longer advisable to postpone the compilation of Code of Practice for the guidance of Public Health Engineers.

5.8.2. A start in this direction has already been made by the Committee set up for the purpose by the Ministry of Health. But much work is yet to be done. As the members of the Committee are constantly preoccupied with their own official duties, it is necessary to detail a Special Officer for the initial collection and compilation of details for the consideration of the Committee. This step, the Panel feels, could expedite the finalisation of the Code.

5.9. Importance of Research

5.9.1. With the growth and development of Public Health Engineering in the country, research on all problems connected with it, both in the applied and fundamental fields, is assuming importance. Continuous vigilance must be exercised to avail the benefits of such research in improving the techniques of design, execution and maintenance of public health engineering works in the rural, urban and industrial fields. A Central Public Health Engineering Research Institute has already started functioning at Nagpur under the C.S.I.R. The Institute is exploring the field for research in Public Health Engineering both on immediate problems and on long range issues so that it could keep abreast of the needs and help in achieving economy with efficiency in all water works and waste disposal installations.

5.9.2. Public Health Engineering in the country is still in its infancy. Engineers, therefore, mostly depend on the equipment manufacturers even in regard to fundamental design factors relating to water and sewage treatment plants. Often, the practice and procedure obtaining in foreign countries is being adopted without any appreciation of the modifications which may be dictated by local factors and conditions. There is a great need for immediate research in regard to the pre-conditioning and filtration of drinking water and the preliminary and secondary treatment of sewage and industrial wastes, so that rational design criteria could be evolved for future adoption. The Panel feels that it should be possible to re-model many of the existing water treatment plants at a small cost to make them yield better and large quantity of filtrate and thereby save a much larger capital investment which would be otherwise necessary in putting up additional filter plants. The Panel understands that the C.P.H.E.R.I. has been able to adopt this course successfully in the case of Nagpur Water Works. Experiments directed towards such immediate problems are bound to yield good dividends not only in the more efficient upkeep and maintenance of existing plants, but also in expanding them at minimum cost.

5.9.3. The Panel would also stress the need for putting up a pilot plant whenever big schemes are envisaged. The pilot plant can be constructed in collaboration with the C.P.H.E.R.I. and can be made a part of the whole scheme. This would enable the authorities concerned to get all necessary data for the design, construction and maintenance of the main plant in a more economical and efficient way.

5.9.4. The Panel wants to draw special attention to the vital and important role that waste stabilisation ponds could play in the development of the sanitation schemes for most of the urban and rural areas in the country. The data so far available from waste stabilisation ponds in operation in the U.S.A. and elsewhere indicate that this method of disposal of community wastes is very well suited to this country and could be adopted with advantage on a large scale. Here again, it is worthwhile to continue research to gain additional data and to decide on the best method and procedure for applying this "poor man's remedy" for sewage treatment and disposal. With a well operated stabilisation pond, a community can even recover protein value from the algae for profitable use. It is gratifying to note that some pilot plants put up in the country are giving satisfactory results. The Panel attaches great importance to this subject and recommends that work on this must be intensified in the C.P.H.E.R.I.

5.9.5. It will be to the advantage of the public health engineering agencies at the State and local levels as also in the private sector to keep in close touch with the Research Institute, refer their problems and benefit by the research work carried therein. The C.P.H.E.O. could well act as a liaison agency in this direction and help in translating the results of research into actual practice in the field. For this purpose, it is necessary that Public Health Engineering Department in each State sets up special division or unit to deal with research problems and keep a close liaison with the C.P.H.E.R.I. and the C.P.H.E.O.

5.9.6. To foster research work on all these vital problems of Public Health Engineering, the Panel would recommend that sufficient amount of money must be earmarked for operational research. It is relevant to point out that the National Building Council, in 1957 took a similar step in recommending that 1% of the Housing Budget be earmarked for experimental housing.

5.10. The Role of the C.P.H.E.O.

5.10.1. The C.P.H.E.O. under the Ministry of Health will have a continuing and important role to play in the future development of Public Health Engineering in the country. In the initial stages, it will have to assist those State Public Health Engineering Departments where there is no separate well established organisation or where such organisation has been recently set up, for technical scrutiny, guidance and leadership in promoting water supply and sanitation schemes. When the State Public Health Engineering Departments are fully established with adequate qualified and trained personnel and when approved Consulting Public Health Engineers also come into the field, the technical scrutiny of projects would gradually devolve from the C.P.H.E.O. to the State Public Health Engineering Departments. It will then be necessary for the C.P.H.E.O. to act as a co-ordinating agency between the different State Departments, establish standard procedures and specifications for adoption in the country, and facilitate frequent and free exchange of ideas between the States and the Centre as well as Public Health Engineers in the private sector. The C.P.H.E.O. will continue to play an important role in collaborating with C.P.H.E.R.I. research abreast of the needs, and evolving improved methods of technique in the design and operation of Public Health Engineering works. In due course, when water supply and sanitation projects are well under way, the C.P.H.E.O. will have to perform the more comprehensive functions relating to Environoment Hygiene now under the purview of the Health (Medical) Agencies. Service and leadership by the C.P.H.E.O. under the Ministry of Health will be continuing need for the growth and development of Public Health Engineering in the country.

5.10.2. In view of the responsibilities the C.P.H.E.O. has to shoulder, it is essential that its status should be elevated, and the head of the Organisation should enjoy at least the same status as that of the Chief Engineers in the Central Government. This is all the more necessary as he has to vet the schemes prepared by the Chief Engineers of the State Public Health Engineering Organisations. He should work as adviser to the Union Ministry of Health and without being subordinate to the Director General of Health Services. It may be pointed out that as far back as 1949, the Environmental Hygiene Committee made a similar recommendation vide page—130 of their report. It may also be mentioned that the T.C.M. Team of Public Health Engineers invited by the Ministry of Health have also strongly recommended the upgrading of the C.P.H.E.O. on a basis parallel to that of the Public Health Medical Services.

5.10.3. The Panel would also recommend in this connection that the personnel of the C.P.H.E.O. should be periodically interchanged with the State Public Health Engineering Officers in order to promote a better understanding of each other's view points which is essential for constructive critical analysis and speedy disposal of work. This will be facilitated if, in future, some of the vacancies in the C.P.H.E.O. are filled by officers drawn from States on deputation.

5.11. Need for Stepping up Production of Essential Materials

5.11.1. It is recognised that Cast Iron pipes are in short supply in the country and this is the main reason for the delay in the progress of many of the schemes. It would appear that of late the position has improved in regard to the supply of the larger size pipes—of 18″ dia. and above. But the position continues to be critical in regard to the smaller pipe sizes ranging from 3″ to 18″ dia. and it is these smaller sizes which are in great need for majority of the water supply projects in progress. The Panel feels that there is an imperative need for stepping up the production of C.I. pipes particularly of the smaller sizes so that schemes are not held up unduly for want of such pipes. Till recently there were only 2 firms manufacturing C.I. and spun iron pipes in the country. Yet another firm has begun the manufacture of spun iron pipes recently and it is expected a few more firms will also come into this field. This will no doubt step up the production of C.I. pipes, but side by side, attention should also be paid to step up the manufacture of C.I. specials which are also equally essential. At present, many of the State Public Health Engineers are compelled to procure their requirements of C. I. specials from local foundries to supplement the supplies they get from the accredited manufacturers. There is need for a coordination of efforts in the entire field of manufacture of C.I. Pipes and specials.

5.11.2. With several agencies coming up in the field of manufacture of C.I. pipes and specials, there is a greater need for establishing proper standards and specifications to ensure uniformity in the quality of the finished products.

5.11.3. The Panel understands that there is an increasing rate of self-sufficiency in regard to the production of G. I. pipes and fittings in the country. But there is a need to ensure better and uniform quality in the interests of better water works practice.

5.11.4. It is also encouraging that the C.I. Sluice valves are already being manufactured by a number of firms in the country. Unfortunately, however, there is no uniformity in the quality of the product turned over by the different agencies. It is necessary to ensure that sluice valves used in the schemes conform to standard water works quality and satisfy a rigorous specification to ensure robustness in manufacture and trouble-free service over a long period.

5.11.5. House-hold water meters are essential for every well managed water works undertaking. Till recently water meters had to be mostly imported. The Panel was gratified to note that the Government factory in Lucknow has made a good start in the manufacture of these meters and that similar meter manufacturing companies are expected to start production of meters soon. Water-meter industry has great future in the country since every built up house in every urban area is expected to have a meter connection as part and parcel of the water supply scheme of the town. It is essential therefore that even at the start the water-meter industry is built up and promoted on efficient lines in order to get meters of good quality at reasonable cost.

5.11.6. Chlorinating equipments of the small, medium, and large sizes will have to play a vital role in ensuring the safety of water supply system all over the country in the coming years. They are needed both for rural and urban schemes. A cheap, durable, foolproof device for chlorinating rural water supply is a *sine qua non*. Many of the devices which have been put in a few of the rural water supply schemes have gone out of repair because of the lack of sturdiness in construction. In urban water supply installations, we have to depend mostly on imported equipments at present for the purpose. Even so, they do not receive the care and attention required in their daily operation due to lack of trained personnel or other reasons. The communities do not thus get the full value of the money invested for such costly equipments. There is not only a great need for the production of simple, cheap and utilitarian device for chlorination suited to the different sizes of water works installations, but also for a continuous follow-up and check-up service of all chlorinators so installed.

5.11.7. The manufacture of electric motors and pumps required for water works is making a steady progress in the country. The production of suitable types of pump sets could be placed, on a more satisfactory basis through a greater coordination of efforts among the agencies involved. An overall assessment of the needs in the coming years will also help in planning the production programme on a realistic basis, as it would place their activities to the better advantage of the water works needs of the country.

5.11.8 The manufacture of sewage pump-sets in the country is however, in its infant stage. This may be partly due to the fact that the demand at present for sewage pumps in the market is few and far between and the range of sizes is too great. With a greater number of sewerage systems being taken up in the Third Plan, the need for sewage pump-sets will automatically increase which would give a fillip to this industry. There is a concurrent need for laying down proper standards and specifications for such pump-sets.

5.11.9. The special equipment required for water and sewage treatment plants are being manufactured exclusively by the few firms specialising in this line. In recent years, they have begun manufacturing such equipments mostly from indigenous material, importing only the barest minimum. When water and sewage treatment plants find a wider field of application in the coming years, it should be possible for Public Health Engineers to standardise the details for such equipment so that their manufacture ceases to be a monopoly and their prices brought down to a reasonable level. Here again, the standardisation of all equipment in the field of water and sewage treatment is an urgent necessity.

5.11.10. When manufacturing firms start the production of the several essential materials required for water works and sewage installations as indicated above, it should be possible simultaneously to produce in the country all other miscellaneous requirements in the field such as venturi meters, air valves, flow regulators, special kinds of pressure valves etc. All activities in this direction in the public and private sectors could be properly regulated if a total assessment of the future needs is made by a competent authority and approximate forecast is given for the benefit of the industry as a whole.

5.11.11. The Panel is making a special reference to the need for a cheap, simple, robust and foolproof type of pump suited for rural water supplies in the country. In fact, the very success of the mechanisation of rural water supply in the country depends on the satisfactory quality of the pump-set that can be produced and installed.

5.11.12. Finally, it is necessary to mention about the urgency for and the importance of the production of certain chemicals used in water works practice. Chlorination is universally adopted in all urban and rural water supply schemes. Production, storage, transport, handling and application of chlorine would require special and careful attention. Equipment should be so designed that each phase of the operation is made cheap, easy and free from all risks. The nature of the chemical to be used for chlorinating rural and urban water supplies would also have to be standardised to suit the magnitude of the different installations. Special standards and specifications will have to be drawn up to ensure the success of the entire operation at all stages.

5.11.13. In most of the urban water treatment plants, the pre-conditioning of water prior to filtration would require chemical dosing and coagulation with an appropriate chemical to suit the particular characteristics of the raw water. Other chemicals not being easily available, alum is being used universally for the purpose. The quality of this material too is widely varying. In many cases, alternative chemicals would be cheaper and more effective depending on the quality of raw water. There is a large field for the production, storage and distribution of chemicals used in water treatment plants. An assessment of the future needs in this field again would be necessary in order to stimulate and channelise the entire industry on proper lines.

5.12. **Proper Choice of Materials**

5.12.1. Side by side with the need for stepping up production of material required for water and sewerage works, there is considerable scope for effecting economy in the cost of the schemes by selecting the type of material to suit the purpose. The Panel observed that even in simple types of rural water supply schemes, 'B' Class Cast Iron pipes are being used where spun concrete or asbestos cement pressure pipes would have been a cheaper alternative, and would have also released critical Cast Iron pipes for better use elsewhere. The hydraulic pressures in rural distribution systems are not high and should therefore permit the use of pipes of cheaper material on a larger scale. The Panel considers that this aspect of the problem deserves special attention of the Public Health Engineers in charge of rural programmes.

5.12.2. Even in regard to urban water supply system, most often, Cast Iron pipes of 'B' Class, which is the lowest class manufactured at present, are used even where the hydraulic pressures in the distribution system are low. A lower class of pipe suitable for such a purpose should be manufactured. In the mean time, economy is possible by the judicious use of spun concrete pipes wherever possible, releasing Cast Iron pipes for more profitable use elsewhere.

5.12.3. Steel pipes are not in popular use in water works practice except in special cases. Hume steel pipes are used freely in some of the States in place of the Cast Iron pipes both in water supply and sewer works. A special protective coating is necessary in the case of steel pipes used in aggressive soils. Certain soils, again, are unsuitable for laying hume steel pipes. Spun concrete pipes have to be used with circumspection in sewer works as they are liable to disintegrate under certain conditions. For this reason, stone-ware pipes and in-situ brickwork, are freely used in all sewer works in preference to other pipe materials.

5.12.4. Because of these various factors, the Public Health Engineer most often chooses to use C.I. pipes wherever possible irrespective of its comparatively higher cost. There is an urgent need for evaluating the comparative utility, merits and demerits as between spun concrete, hume steel and steel pipes and for laying down standards in regard to their manufacture and use in water and sewer works.

5.12.5. The Panel considers that there is a good future for prestressed concrete pipes in all urban water supply and sewerage projects. These pipes cost less than C.I. pipes in the higher range of sizes. Their use would enable the conservation and diversion of Cast Iron for manufacture of the smaller sizes which are very much short in supply.

For the manufacture of pre-stressed concrete pipes in the country, however, import of high tensile steel will be necessary until it can be manufactured in the country. The production of prestressed concrete pipes required for water supply and sewerage projects merits immediate attention even if it should necessitate the import of high tensile steel for some initial period. The economy resulting from the use of prestressed concrete pipes in the place of Cast Iron would compensate for the foreign exchange involved.

5.12.6. The Panel understands that Prof. Nervi who has developed his own system of pre-stressing pipes has given the right to adopt his patent to the Government of India free of cost. There are other patents in force, both in the Continent and in the U.S.A. It is desirable that every encouragement is given for the manufacture of prestressed concrete pipes in the country, after laying down suitable standards and specifications in this behalf.

5.13. Operation and Maintenance of Schemes

5.13.1. Collection of Data from Existing Plants

It has been mentioned earlier that the maintenance of water and sewage treatment plants did not receive that careful attention as it should. Logging of daily results were not done in most of the cases and in a few cases where results were recorded, no systematic procedure was followed. Careful collection of data regarding the daily performance of all existing plants would be very valuable in designing future expansions of the plants and in building new ones elsewhere. This aspect of the problem deserves serious consideration.

5.13.2. Building up of Load of Water Supply and Sewerage Schemes

The Panel has noticed that the load build up (increase of water and sewer connections) is very slow on most of the water supply and drainage schemes which naturally affects their economic and efficient functioning. The Panel, in this connection, would suggest that the local bodies should take steps to impose water and drainage tax where they have not done so, and strictly collect the same. This would act as an incentive for the house owner to take connections quickly.

5.14. Civil Structures in Water Supply and Sanitation Schemes

5.14.1. As mentioned earlier, the buildings put up in connection with water supply schemes have not in many cases, been designed economically.

In certain cases, elaborate buildings have been put up where they are unnecessary. In one case, costly northlight roofing has been provided and what was more it was facing west. The Panel would like to emphasise the need for effecting maximum economy in buildings connected with water supply and sanitation schemes.

5.14.2. It is not necessary everywhere to have roofing over the filters. In temperate climate, it is the practice to have the filters in open air. Roofing is restricted only to the control area. The Engineers incharge of Public Health Engineering Works should use discretion in designing civil structures.

6. LONG RANGE REFORMS

6.1. Pattern of Financing

6.1.1. The Panel has advisedly set out the foregoing as measures for immediate implementation under the current Plans. These, however, cannot achieve the completion of the entire programme—urban and rural—within any foreseeable time. It is therefore necessary to explore alternative ways and means for accelerating the pace of progress so that the Nation's Health can be placed on a satisfactory footing without avoidable delay. Such acceleration is possible only if substantially bigger allotments than hitherto are made in the succeeding Five Year Plans. In an earlier Chapter, the Panel has indicated that an yearly allotment of the order of Rs. 56 crores would be needed if all urban and rural schemes are to be completed in a period of 25 and 15 years respectively. Obviously an allotment of such magnitude may not find a place in the Five Year Plans under the present context. It therefore becomes imperative to make a radical departure from the existing methods of financing such essential schemes.

6.1.2. If the Central and the State Governments cannot find the money on any adequate scale to complete the entire programme within a reasonable period, the question arises as to how far it is practicable for them to continue to act as financiers for local bodies in this behalf.

6.1.3. It is the local bodies who play a pivotal role in the implementation of Water Supply and Sanitation Schemes. The responsibility and the initiative for promoting a scheme, formulating proposals therefor, getting them implemented and operating the completed schemes, with repairs, replacements, and renewals through the years rests primarily on the local bodies concerned. The method of financing these schemes must be such that it would enable the local bodies to shoulder this initial and continuing responsibility in a satisfactory manner.

6.1.4. An irrigation or an electricity project brings benefit to the population at large, and to that extent it may qualify for being promoted as a State undertaking, with finances found from the State or the Central exchequer, and with revenues realised from the beneficiaries at large. But a water supply or a sewerage system for a particular urban unit, benefits the local population solely, and the burden—financial and otherwise thereof falls exclusively on them.

6.1.5. Unfortunately, local bodies under the present set-up are seldom in a position to undertake such costly schemes from their own resources. They seem to be saddled with duties and responsibilities beyond their financial capacity. Their only main source of income from the property tax is inelastic while their expenditure is ever on the increase. Moreover, the pattern of financing hitherto adopted, for implementing urban water supply and sewerage projects, has established a convention that, without substantial grant-in-aid from the State Government, local bodies could never hope to have their water supply or sewerage schemes installed. Completed schemes have been handed over to local bodies concerned for day-to-day management and maintenance, without any attempt to place the installations on a sound and self-supporting basis. Local bodies have been looking upon these schemes as partial gifts from the Government, and there has been no incentive to make them remunerative and self-paying for future improvements and expansions. The problem did not assume any magnitude so long as water supply and sewerage schemes in the country were relegated to the background, and any progress attempted in this direction was haphazard and spasmodic.

6.1.6. Usually, under the present pattern of financing urban schemes, many a local-body finds itself unable to pay the annuity and interest charges on the capital loans borrowed for installing the schemes. Hence the need for the State Government to step in and make an out-right grant-in-aid towards such part of the capital outlay as the local body cannot repay from its own resources. The quantum of such assistance varies from State to State. It is only in two or three States that the local body is obliged to implement its water supply system from its own resources entirely, without any grant from the State Government. But an urban sewerage system nevertheless requires subsidy from the Government.

6.1.7. The installation of a water supply scheme in any urban area makes a sewerage scheme for that area inescapable. Without the sewerage scheme as a complement, the urban area may be said to have escaped water borne diseases only to face accentuated insanitation and diseases resulting therefrom. For this reason, local bodies will have to provide a sewerage system side by side with water supply. To enable them to do so, it is necessary to treat water supply and sanitation schemes as combined utility projects, financed on a common basis. The financial advantages accruing to the community from such projects should be evaluated on a realistic basis.

6.1.8. The invisible benefits of a water supply scheme, namely immunity from water borne diseases, is universally recognised; but its monetary equivalent as reflected in the well being of the community, a higher manpower potential, and a reduction in the medical bills of the individual and the States, is seldom worked out, much less taken into account. The provision of a sewerage system for a town confers, likewise several indirect and invisible benefits on the community. It does away with the need for maintaining an army of people engaged in the unpleasant task of night soil conservancy, transport and disposal; it eliminates the need to maintain long lengths of earthen drains functioning as elongated cess pools all over the town; it removes the need for maintaining a gang of Public Health personnel to oil and spray nuisance spots in the town to mitigate the mosquito nuisance; it saves a heavy and recurring annual expenditure on anti-malarial, anti-filarial and anti-mosquito measures. It also reduces the medical bill of the individual family and reduces the expenditure on medical bills to the municipal and State maintained hospitals. All these benefits must be assessed in terms of money values in order to equate the advantages which water and sewerage projects confer on the community.

6.1.9. Such a re-assessment of values is not only rational but is necessary in order to view the financial aspects relating to water supply and sewerage schemes in their proper perspective. The question now arises as to how water supply and sewerage systems could be successfully financed and on a common basis. Some radical re-orientation of ideas is called for in dealing with this problem. We could perhaps take a lesson in this connection from the more advanced countries like the U.S.A. and the U.K. who, half a century back, were placed more or less in the same predicament as we are today. By a process of elimination of other possible methods of financing, those countries eventually adopted a progressive and self-contained method under which local bodies proceeded to raise loans in the open market to finance their schemes, and repaid the loans through the years from the municipal taxes and revenues from the sale of water, charges on house frontage, sewer bills and like. This method, by popular acceptance and adoption has subsequently come to stay and has justified itself by the rapidity with which such schemes have been implemented in the recent decades.

6.1.10. This method however, will call for certain adaptations to suit the limitation of local finance in this country. Similar to the fixed charges in the U.S.A. which includes a general tax on the property, our municipal towns too have fixed charges in the shape of water and drainage tax forming part of the general property tax. But the rate structure is low since the rentals reflect, as they must, the comparatively poorer per capita income of the population. Moreover, a sizeable portion of the population in our urban towns lives in temporary huts and on pavement not assessable for any rental value. The taxable proportion of the total population is, thereby appreciably reduced. Similarly, water revenues by way of sale of water are confined to that portion of the population which alone can enjoy the amenity of a house service-connection. All the same, the scheme has to be designed to supply the entire population uniformly at the assumed per capita rate of supply. In effect, it is only a part of the total population which has to pay for installing and maintaining the water and sewerage facilities for the benefit of the entire population in urban areas. It is of interest to note in this connection that public fountains are not usual at all in the advanced countries, whereas they form an essential feature of the distribution system in most of our urban water supply schemes.

6.1.11. If, therefore, the schemes are to be made self-supporting, the cost thereof must have a practical relation to the paying capacity of the local population. The only practical way to keep down the cost would be to design the scheme with minimum standards to start with in regard to per capita rate of supply and distribution criteria, with provision for expanding the scheme at later stages as and when the population can afford it. The criteria for the standards to be adopted in the initial stages should not be based on the ideal or the optimum obtaining in more advanced countries but on the practical and the minimum which an urban community can finance with the limited resources at its disposal and which would fit in with the actual stage of its development in the socio-economic sphere. Urban sewerage systems would also have to follow the same pattern of development.

6.1.12. These and similar modifications to suit local conditions will no doubt be necessary to make this method of financing viable. Nevertheless, the idea itself is not quite new to this country. A few Corporations and even Municipalities have been raising loans in the open market to finance their Public Works. But this method has found limited application in the field of water supply and sewerage schemes, presumably because of the concept that such facilities should be subsidised by the

Government. But this concept is now fast changing and the urban population are clamant for these facilities, and are also willing to pay for them. The stress of urban and industrial life without these basic amenities is a compelling factor in this direction. The Panel feels that this awakening should be mobilised and properly channelised to promote this new method of financing among the urban masses.

6.1.13. The method of financing and the agency to be set up for the purpose will have to be patterned to suit local conditions, with special reference to the inter-relationship between Municipal agencies and State Governments in the country. The first alternative that suggests itself is that the local body concerned may itself be empowered to raise a loan in the market and sell water bonds or debentures for raising the capital requirements for installing its water supply or sewerage project. The municipal corporations already enjoy such power to a certain extent. In fact, the Bombay Corporation is already there as a successful example in support of this venture.

6.1.14. But such a course may not, in most cases, produce fruitful results. Local bodies in their present status in the country are still in their formative stages. Their administrative machinery and financial capacity cannot be said to have been placed on any satisfactory footing yet. Local administration is inevitably tied up with local politics. It is only a question of degree between one place and another. In the circumstances, the success of the entire plan may be jeopardised if each local body proceeds to act on its own and invite loans from the market for prosecuting its water supply and sanitation schemes. But, for a long time yet, and until the common man has been educated into this new line of approach, it would be necessary in the interest of the success of this venture that a number of municipalities in a region are given the benefit of the services of a Regional Statutory Water and Sewage Board which would act on behalf of these municipalities in the region, taking over such functions and duties from them as are necessary to work the Plan to success.

6.2. Regional Water and Drainage Boards

6.2.1. The functions of this Agency would cover not only the role of financiers but would also embrace all activities necessary to work the entire plan as an efficient technical and business venture. The creation of an independent statutory body or bodies armed with powers to take over the functions of local bodies relating to the provision of these amenities would be the first step. Such a statutory body will also infuse confidence in the subscribing public that their investments would be properly safeguarded.

6.2.2. It is not the intention of the Panel that such a Regional Board should usurp the powers and functions of the local body in any manner. The Regional Boards, if anything, should be looked upon as the agents of the several municipalities concerned for the effective and efficient management of the schemes for and on behalf of the municipalities rather than act as an independent and superior unit in an administrative heirarchy. The Panel visualises that the Regional Boards, when invested with such powers and functions, would employ competent technical agencies to carry out preliminary surveys and investigations and draw up estimates and execute urban schemes within their region. They would also attend to the efficient maintenance of the schemes.

6.2.3. The Board will sell protected water in bulk to the local bodies concerned. It will devolve on the local bodies to arrange for the internal distribution of supply within their respective areas, collect the water charges and pay the Regional Boards for the water purchased. If any particular local body should so desire, the Regional Board could also attend to the internal distribution of water and collection of water dues.

6.2.4. Like-wise, the Regional Water and Sewage Board would promote, plan and execute the sewerage project for the entire town, subject the sewage to proper treatment and sell the effluent for beneficial farming at suitable tariffs. The proper maintenance of the sewers within the town should be left to the local body. While the payment for water consumed would be based on quantity supplied at agreed tariffs, payment for sewer facilities may be based on the number of water closets and bath-rooms in the house, property frontage and similar factors.

6.2.5. The Panel is conscious of the fact that this idea of running water supply and sewerage schemes as business ventures through the agency of Regional Board may take some time to find proper acceptance among local bodies. It is refreshing to find that two or three States are already pursuing this line of approach. The Panel has to mention Uttar Pradesh in this connection. The Madras Government have also passed an order to the effect that urban water supply schemes will be financed by the local bodies as a self-paying proposition without any subsidy as such from the State Government. The Panel was also gratified to find that this idea found favourable response from the State Officers and Ministers with whom it discussed the subject during its visits. The Chief Ministers of U.P., West Bengal and Mysore were favourably impressed by the line of approach for the future progress of urban schemes in the country. The Third Public Health Engineer's Conference convened by the Health Ministry in New Delhi in October, 1958 has also gone into this question at some length and has expressed itself in its favour.

6.2.6. It may be argued in some quarters that as the State and the Central Government are raising loans in the open market to finance all Development Projects included in the Five Year Plans, there may be no more money available to tap for water supply and sanitation schemes than what is already assumed to be available and provided for in the Plans. The Panel is unable to subscribe to this view. Urban population is getting increasingly insistent for these basic amenities of civic life. They may not wait indefinitely for years before their schemes could be implemented with the inadequate allotments made under the Five Year Plans. The Panel is confident that investors would be able to subscribe readily and liberally towards a local loan intended for their local amenities as they would be the immediate beneficiaries. Such investments for specific local facilities are not likely to affect the investments from the general public for the Five Year plans to any appreciable extent. It is reasonable to expect that the felt need for water supply and sewerage facilities in many of the urban areas would bring in encouraging response from the local urban population for the purchase of water bonds or debentures as the only means for securing these amenities in a reasonably short period. At any rate, it is worthwhile to pursue this line of action to raise additional funds for water supply and sanitation schemes.

6.2.7. The Panel has therefore no misgivings on the successful outcome of such a venture if pursued vigorously by all the States. A certain amount of initial education, and leadership would be necessary in order to wean the urban citizen and the local body from their established conventional notions that drinking water should be provided as a partial gift by the Government. In the initial stages of the development of this method of approach, the Panel would recommend that Regional Boards may be set up in such of the States and in such areas where the people are already familiar with this idea. It is understood that loans are advanced by the Life Insurance Corporation of India for housing projects of State Governments and other agencies. There is no reason why loans could not be secured similarly for demonstrable remunerative water supply and sanitation projects for communities where there is popular support for this new method of approach.

6.2.8. The Panel understands that the West Bengal Government propose to set up a Metropolitan Water and Sewage Board to cater to the Greater Calcutta area and to include in its purview a number of municipalities on either side of the Hoogly. This is a step in the right direction and should serve to stimulate similar action by other States.

6.3. The Importance of Organisation

6.3.1. The pursuit of a new method of financing urban water supply and sanitation schemes with Regional Boards set up for the purpose, as discussed in the foregoing para, would bring in its wake the problem of setting up a broad-based Public Health Engineering Organisation in the States.

6.3.2. The Panel has already discussed the imperative need for setting up independent Public Health Engineering Departments in each State to get over the existing handicaps in the working of the Plan. With the financing of the projects placed on a sounder footing in future years as now visualised, it would be inescapable to build up and expand independent self-contained Public Health Engineering Departments in each State to cope effectively with the expanding volume of activities which will inevitably fall on the Public Health Engineer. Much of the criticism that is now put forward against the creation of separate Public Health Engineering Departments in the States is based on a lack of understanding of the totality of the problem which awaits solution in the coming years. With an increasing work load in the coming years, the need for a separate and independent Public Health Engineering Department can no longer be a question for debate. On the other hand the problem is how best could such a Department be created and expanded without further loss of time.

6.3.3. The Panel visualises that in the initial stages of the working of the long range Plan with Regional Boards brought into the picture, the technical work involved in investigating, designing, executing and maintaining of such schemes within the State would continue to fall on the Public Health Engineering Department of the State. Centage charges worked out on a rational basis will be paid by these Boards for the services rendered by the Public Health Engineering Department of the State. The State Department will have to increase and expand its cadre in order to cope with the volume of workload it is called upon to handle by the Regional Boards. The State will also have to arrange for the recruitment and training of officers in the different grades to befit them for their duties and responsibilities under the programme.

6.4. Public Health Engineering Consultants

6.4.1. When the momentum under this programme increases progressively in future years with an increasing number of urban schemes coming up for implementation at an accelerated pace, it may be that the State Department of Public Health Engineering by itself may not be able to cope with the increasing demands on its services. When conditions should have reached such a favourable state of expansion, it is reasonable to expect that consultant Public Health Engineers would have also come into the field. By that time the Code of Practice with detailed standards and specifications would have been laid down and consulting Public Health Engineers with their competitive talents should bring in efficiency and improved techniques in the different aspects of the works. In order to foster and develop the progressive growth of the consulting engineering profession, the Panel considers that it is necessary to frame now itself rules for registration, licensing and conduct of business and that the Union Health Ministry should take action in this behalf.

6.4.2. Under such a future set up, the Regional Board or Boards would be in a position to get their schemes also prepared by the consulting Public Health Engineers which could then be got scrutinised by the State Public Health Engineering authorities in order to ensure that correct standards and specifications are being followed. The State Public Health Engineering Department would thus have to play the dual role of promoting schemes on their own and exercising a healthy scrutiny of the schemes prepared by other agencies.

6.5. Need for a Board for Water Resources and Pollution Control

6.5.1. During the course of the study the Panel came across several instances where water supply and sanitation schemes have suffered due to want of adequate co-ordination between various agencies, especially in regard to the water resources available in the area and the method of its utilisation. Similarly, there does not also appear to be any control over the pollution of rivers and other water resources. Disposal of industrial wastes has not received as much attention as it should. In certain cases the Panel saw crude waste from industries discharged into a water course without any treatment. Even in cases where there was some system of treating the waste, it was not done satisfactorily. Mapping of water resources in different parts of the country and laying down policies for its economic and efficient utilisation is a matter of great importance. Equally important is the need for effecting adequate control over pollution of water resources.

6.5.2. River pollution has assumed a disturbing magnitude in industrially advanced countries mainly because of lack of control in the initial stages. We, in India, are in a comparatively better condition today as we are in the initial stages of industrialisation. It is necessary for us to draw lessons from others and try to take precautionary measures in time.

6.5.3. Considering the importance of this issue, the Panel would recommend the setting up of a Board in each State to survey water resources, draw policies for its utilisation and take effective measures for controlling water pollution. The Board should be a broad based one having the representative of concerned State Departments, local bodies and important industries in the region.

7. RURAL WATER SUPPLY AND SANITATION

7.1. General Background

7.1.1. Rural water supply facilities, as mentioned earlier, have been executed under four different programmes in the Five Year Plans. The Community Development Programme, Local Development Works and the Programme for the Welfare of Backward Classes include provision for rural water supply and sanitation primarily to supplement the efforts of the local Communities. The Panel understands that the total expenditure incurred on the rural water supply works under these programmes during the First and Second Plans is about Rs. 39.25 crores. The scope of the works carried out under these three programmes relates mostly to the construction of new wells in areas where there are none and also renovation of the existing wells. The Panel understands that there is no intelligent measure of the physical achievements attained under the three programmes except perhaps what is reflected in the numerical number of the wells dealt with. Any correct evaluation of the achievements under the programme must therefore be difficult.

7.1.2. The National Water Supply and Sanitation Programme, which is administered by the Ministry of Health, is concerned with those schemes which require a measure of technical skill on design and construction. The intention while initiating the Programme was to include in its purview only such schemes where water supply to groups of villages from a common source was contemplated. The Programme gives priority to areas of great water scarcity and areas where water borne diseases are endemic. 133 such schemes estimated to cost Rs. 13.5 crores were approved during the First Plan period most of which, were continued into the Second Plan. During the Second Plan, additional 158 schemes estimated to cost Rs. 4.9 crores have been approved. All these schemes cover some 15,000 villages and the population to be benefited will be roughly 16 millions.

7.1.3. Although the programme ostensibly included piped water supply to groups of villages from a single source, it appears that many of the States were not alive to this selective aspect of the programme. The Health Ministry had to approve a large number of rural water supply schemes for a total estimated cost of some Rs. 13 crores towards the closing stages of the First Plan. A proper and complete check was not possible at that time. The projects were approved in principle subject to details being submitted for scrutiny in due course but such details were not furnished by many of the States subsequently. The schemes under implementation by the several States under the Programme included a variety of projects such as individual tubewells, dug, driven or built wells and the like, along with piped water supply for villages.

7.1.4. A scrutiny by the Central Public Health Engineering Organisation of a number of such schemes furnished by the States brought out a startling disparity in the per capita cost involved. Admittedly, geophysical and hydrological conditions vary from place to place, within the same State and between one State and another. But the Panel learnt with surprise that the per capita cost of rural water supply schemes in progress range from Rs. 5 per head to as much as Rs. 500 per head of the village population benefited. The Health Ministry had therefore to issue a circular letter to all the State Governments drawing their attention to this disturbing factor and laying down a directive that, as far as possible, rural water supply schemes under the Programme should be limited to a maximum per capita cost of Rs. 30. The schemes at present being sent up for consideration seem to receive closer attention in regard to the per capita cost involved.

7.2. The Programme in the Third Plan

7.2.1. The future of the Rural Water Supply and Sanitation Programme under the Third Plan does not seem to be well defined yet. There is a large volume of opinion among Public Health Engineers and Administrators that this Programme should include in its purview not only the restricted schemes of piped water supply for groups of villages, but also the simpler types of tube well and bore wells installed with pumps. There is also the opinion held in other quarters that these simpler types of schemes could be carried out by other agencies in the field under the other three Programmes. The Panel sees no objection to the execution of the simpler types of rural water supply systems by the available agencies in the field under the Community Development Programme, Local Development Works and the Programme for the Welfare of Backward Classes, so long as they include only the construction of simple wells-dug, driven or built type involving not much of technical skill. But the Panel considers it essential that the National Water Supply and Sanitation Programme should not only include the selective types of supply for groups of villages from single source but also rural water supply schemes which involve engineering skill and experience either in the development of the source or in the distribution of the supply and in the maintenance of the schemes irrespective of whether such schemes pertain to individual villages or groups of villages.

7.2.2. Bulk of the work under rural water supply is likely to be entrusted to the other three programmes in the Third Plan. The Panel would like to sound a note of caution in this connection. Rural Water Supply facilities have been provided under the four different programmes during the First and Second Five Year Plans. But even at this stage, it is not possible to evaluate the actual progress and physical accomplishments under these programmes. Only broad assumptions have to be made in regard to the total quantum of work so far completed and the work which awaits accomplishment. This is mainly due to the multiplicity of agencies engaged on the work and a complete lack of co-ordination among them. For the future success of the Programme and efficiency in its operation, it is necessary to remove such avoidable handicaps. The Panel appreciates that rural works of this nature involve intimate contact with the villager and liaison with the village level workers on the part of the agency promoting these schemes. It may not be possible for the Public Health Engineering Department of a State to extend its organisation independently down to the level of the village. Responsive participation by all other local officers down to the village level would be a necessity to make the entire programme feasible of operation. It is presumed that the field agencies set up under the Community Development Programme, Local Development Works and the Programme for the Welfare of Backward Classes, would have such a structural set up.

7.3. Need for a Unitary Agency

7.3.1. There is one essential factor for the success of the entire Programme which cannot be ignored viz, the necessity of a single agency and administrative machinery exercising unitary control over the entire programme for rural water supply and sanitation in each State to co-ordinate the activities, regulate the progress and evaluate the programme at all stages. The absence of such a unitary agency has not only detracted from the efficiency of operation but has also made any proper evaluation of the results difficult if not impossible. This unitary agency should work in collaboration with the Public Health Engineering Department of each State in order to draw adequate technical supervision and guidance. The Public Health Engineering Department should take in its own purview the planning, execution and maintenauce of the more difficult types of schemes involving, technical skill and experience. In regard to simpler types of rural schemes implemented by the field staff under the community development and local development agencies, the Public Health Engineering Department will exercise overall technical control and tender counselling service at all stages through its district officers. Technical guidance would also be afforded by the issue of suitable type designs and educative technical pamphlets and manuals for the operation and maintenance of such schemes. Such an arrangement would facilitate the simultaneous execution of a large number of rural water supply and sanitation schemes utilising the services of all available field staff and the different agencies administering the programmes.

7.3.2. It should also be made obligatory on all these agencies to furnish consolidated reports to the Public Health Engineering Departments of the States setting out all relevant technical and factual data in regard to the rural schemes that are being taken up and completed from time to time. From these reports a comprehensive inventory could be made available to the State and Central Governments in regard to the nature and method of development of the source for any village water supply; the initial expectations and final details of the source as completed including quality and quantity of the supplies developed; the estimated and actual cost of the installation; the nature of mechanical equipment, the number of people benefited, the agency for the maintenance and details of maintenance where necessary. The Public Health Engineering Authority of the State would then be in a position to keep a vigilant supervisory check over all activities of rural water supply schemes in each State irrespective of the agencies engaged under the different programmes.

7.3.3. The Panel would emphasise that the exclusion of the Public Health Engineering Department of the State from the implementation of rural schemes under the different programmes, will not be conducive to economy or efficiency. The State Public Health Engineering Department can participate in the different programmes by loaning officers in suitable categories to different agencies under each Programme so that technical guidance and supervision would be available in the field at all stages. These technical personnel could also help in compiling useful statiscal data in regard to the schemes handled by the several agencies and make it possible for the Public Health Engineering Department to keep track of the progress being made and evaluate the programme from time to time. It would also enable that Department to make a state-wise inventory of all water resources and requirements. The preparation of such a basic inventory by each State Government of the Rural Water Supply needs, resources, and forecasts is essential. Two or three States have made such a total assessment already. Other States must follow suit so that the programme of work in coming years can be made purposeful and well planned. It would also be desirable to include in the coming National Census operations, collection of comprehensive data on the present status of rural water supply and sanitation facilities.

7.3.4. The Central Public Health Engineering Organisation under the Health Ministry could function as the technical coordinating authority for all the rural water supply schemes which will be administered by the different Ministries under the four different programmes of the Third Plan. This would ensure uniformity of standards and procedures for planning, construction and maintenance.

7.4. Maintenance of Schemes

7.4.1. It is a distressing experience that many of the completed rural water supply schemes suffer from bad maintenance or no maintenance. Any minor defect even in a hand-pump installation throws the villager into a helpless state driving him to seek temporary alternative unsafe water supplies. The case is worse where power-driven motors and similar equipment are provided as part of rural water supply schemes. Opinion is unanimous in all quarters that the maintenance of such schemes poses a problem which is not yet fully appreciated by the sponsors of such schemes. The Panel may cite the instance of a major comprehensive scheme for a group of nine villages completed in a State at a cost of about Rs. 12 lakhs, which though practically completed, was not brought into operation for a considerable length of time, as the question of responsibility for its maintenance (financial and otherwise) was pending solution all the time. Self-help alone inculcates a pride of ownership. When rural water supply is installed at the cost of the State and Central Governments, the rural community is apt to expect the Government to maintain the facility also for their benefit. There is resentment when something goes wrong and the supply fails. It requires a measure of civic sense and a level of enlightened education before the entire community can be trusted to maintain a complete installation at its own cost and make a success of the job. The Panel has seen or heard of very few such satisfactory cases.

7.4.2. The Panel must specially mention a common defect noticed in many of the completed rural water supply schemes. It is the provision of inferior water taps of different types fixed to public stand-posts instead of a self closing one. Such inferior taps do not give satisfactory service for long and there is considerable waste of water due to leaky and open taps. It is false economy to provide cheap and inferior quality, non-self closing taps particularly in rural schemes where the entire supply is through public standposts. The Panel would recommend the provision of self closing taps of robust and approved make for all standposts as part and parcel of schemes approved by the State and Central Governments.

7.5. Scope and Magnitude of the Problem ahead

7.5.1. There is hardly any authoritative data on which one could hazard an opinion in regard to the total financial commitments involved in completing all rural water supply schemes of the entire country. The Third Public Engineers' Conference attempted to estimate the total cost of rural water supply including sanitation at Rs. 600 crores. If only minimum facilities are to be provided in the first instance, this figure could perhaps be assumed as Rs. 300 crores. The figure may be of the order of Rs. 200 crores if sanitation facilities are excluded. Even then, any programme which aims at completing minimum rural water supply facilities all over the country in the next ten years or so would call for an expenditure of the order of Rs. 20 crores every year. Part of it may be shared by the village communities, but its extent and shape will largely be dictated by local conditions. The magnitude of the Programme is such that whoever be the field agencies carrying out the works under different Ministries, it is necessary that there is a technical co-ordinating authority both at the Centre and at the State level to help in the economical and effective implementation of the entire programme. The C.P.H.E.O. and the State Public Health Engineering Department should be fully utilised in this behalf as explained earlier. The agencies in charge of the Programmes must pay special attention to the maintenance of the schemes as well. In the case of piped supplies, the issue is all the more important and the responsibility for proper maintenance and management should be fixed even before such schemes are initiated. Some machinery should be set up in order to keep a check over all completed schemes and carry out periodical servicing of mechanical equipment to keep them in working trim.

7.5.2. In this connection the Panel would stress on certain minimum standards necessary to ensure the safety of the supply drawn from simple types of rural wells. Usually wells of the dug or sunk types are left open to the sky and the users are allowed to draw water from the wells, with their own ropes and buckets or with a common rope and bucket. In such cases, even if the quality of water from the well may be safe, there is constant risk of pollution of the supply from the users and the ropes and buckets which they use. A well open to the sky is also liable to contamination from droppings. It is therefore essential that a well is invariably covered over and provided with hand-pumps to prevent contamination. The provision of handpumps should therefore be regarded as an essential aspect of protected water supply in rural areas. The provision of hand pumps will have to go side by side with the education of the people in the use of hand pumps and in their proper maintenance. It will also be necessary to encourage the manufacture of cheap, foolproof and robust hand pumps for use in the village with standardized spare parts supplied at cheap rates.

7.5.3. On the question of rural sanitation, the Panel feels that it may take some time for the villager to realize the importance of a water-sealed privy in his house for the healthy living of the village community. The experimental projects set up by the Ford Foundation at Madras, Calcutta and Delhi as also the W.H.O. Pilot Projects at Trivandrum and Lucknow are contributing to the finding of a solution to this problem. The response for water sealed privies has been most encouraging in Kerala, obviously because of the high percentage of literacy among the population. The Panel considers that while the problem of village sanitation should not be lost sight of, one should not force the pace any faster than the readiness of the villager to accept such facilities. In any case, the question of rural water supply should receive immediate priority and the villager trained to receive the concomitant facility of sanitation as soon as possible.

7.6. Suggested Pattern of Financing Rural Schemes

7.6.1. The Panel would here deal with a major issue relating to the scope of the rural water supply programme. The benefit of a fifty percent grant-in-aid is now confined to villages with a population up to 5,000 only. Any rural or urban unit having a population of 5,000 is eligible only for a loan assistance under the programme.

According to the 1951 census, villages with a population range of 5,000 to 20,000 had a total population of about 32.43 million, whereas towns with a population exceeding 20,000 had a total population of 42.91 million, or roughly the ratio was 3 :4. The Panel came across suggestions from certain quarters that the scope of the rural Programme should be extended to populations up to the limit of 10,000 at least if not to the higher figure of 20,000. The Panel does not favour this suggestion. With the limited funds under the programme, if village communities with population from 5,000 to 10,000 or 5,000 to 20,000 were also to be helped with subsidies for their works, it would, to that extent, deny such facilities being given to a larger number of villages in the population range below 5,000. This would be a handicap to the smaller villages which admittedly stand in need of immediate amelioration in regard to their water scarcity. Moreover, semi-urban units with a population range of 5,000 to 10,000 or 20,000 would inevitably call for the provision of a more elaborate system of piped water supply, with a per capita rate of not less than 15 gallons per day, in order to meet the minimum demands of such semi-urban population on accepted standards. Such supplies can hardly be termed 'rural' and can hardly qualify for a full grant from the State and Central Governments. It would make the cost of the programme unduly heavy. Communities with a population range of 5,000 to 20,000 are supposedly to be credited with a certain measure of financial capacity to meet their civic needs. The figures of 20,000 has been assumed as the limit above which these semi-urban units would opt for municipal constitutions.

7.6.2. There is, however, an anomaly in the situation. The State Governments which obtain a loan assistance from the Central Government for their urban schemes are prone to distribute such loans to the more solvent and prosperous Municipalities and urban units which have adequate resources to repay such loans against their water supply schemes. The smaller urban units in the population range of 5,000 to 20,000 which do not enjoy the same measure of financial competence, are apt to be left behind in the Programme. It is these medium semi-urban villages which might thus suffer a double disadvantage under the existing programme. While they do not qualify for a grant-in-aid on the score that the population exceeds 5,000, they may not also be in a position to finance their schemes entirely from their own resources and repay the loan therefor. As the proportion of the less fortunate and more fortunate urban communities is in the ratio of 3 : 4, it is desirable that the scope of the National Water Supply and Sanitation Programme is modified in order to give more equitable opportunities to the urban communities under the loan disbursements. It is suggested that instead of a total denial of any grant-in-aid to villages with population above 5,000, the programme may include a 25% grant-in-aid for villages or towns with a population between 5,000 and 20,000. The loan assistance without any grant-in-aid can be offered as heretofore to urban areas with a population exceeding 20,000. Such a proposal would give an element of rationale in the aid contemplated under the Programme, and would approximate to a slab system of help to the rural, semi-urban and urban populations in the country. Provision should be made for this purpose in the future budgets earmarking funds specifically for these three different categories.

SUMMARY OF IMPORTANT RECOMMENDATIONS

Serial No.	Reference to para	Recommendations
1	5·2	The existing procedure of allocating funds on a year to year basis and the belated information to the State Governments regarding availability of funds for any year leave very little time for the authorities in the States to plan for the projects, to procure materials and incur expenditure. The only practical solution to speed the pace of work would be to place the financing of this programme on a three or at least two year basis as a special case.
2	5·3·1	The preparatory work required to be done before a scheme is taken up for planning is prolonged and cumbersome. It should be possible for the State Governments to reduce procedural delays, fix up priorities for various schemes and take preparatory work on them well in advance. It is equally essential for the State Governments to detail special staff for the advance investigation and preparation of projects.
3	5·3·2	State Governments should take advance action in regard to land acquisition proceedings relating to water supply and sanitation schemes so that there is no avoidable delay in the execution of component works of the scheme.
4	5·3·4	Inter-State sales tax at the rate of 7% is charged from the Corporations and other Local Bodies while the State Governments have to pay only 1% on their inter-State purchases. Government should consider this and remove the disparity in the levy of sales tax.
5	5·4·3	The concerned agency in the State should furnish details of the schemes in the specific form laid down for the purpose, in order to avoid unnecessary duplication of work and delay.
6	5·4·4	The Health Ministry may explore ways and means of cutting short existing procedural delays in according sanctions to schemes.
7	5·5·1	An analytical study should be made of the actual expenditure incurred by Government Departments on various schemes planned and executed by them on behalf of local bodies with a view to fixing centage charges on a rational basis.
8	5·6·1	State Governments should set up a separate Public Health Engineering Department where they have not done so.
9	5·6·2	The cadre of municipal engineers should be provincialised and integrated with Public Health Engineering Department to ensure interchangeability and continuity of experience of personnel in all aspects of water supply and sanitation works.
10	5·7·2	It is desirable to arrange for refresher courses to the different grades of in-service-personnel at suitable centres in the States.
11	5·7·3	A National Water and Sewage Works Association should be formed to act as common forum for free exchange of ideas on the problems met with in the operation and maintenance of water treatment and sewage disposal works.
12	5·7·4	The Conference of Public Health Engineers should be held at least once a year.
13	5·7·5	It is necessary to standardize the qualifications and training of plant operators of different grades in order to bring them under National Certificate Scheme. The Ministry of Health should take the necessary measures in this behalf in consultation with the State Governments.

SUMMARY OF IMPORTANT RECOMMENDATIONS—*contd.*

Serial No.	Reference to para	Recommendations
14	5·8·1	A common code of practice laying down standards and specifications in design and execution of Public Health Engineering Works is an imperative need.
15	5·9·2	The Central Public Health Engineering Research Institute may intensify research work in regard to pre-conditioning and filtration of drinking water and the preliminary and secondary treatment of sewage and industrial wastes in order to evolve rational design criteria for future adoption.
16	5·9·3	There is a need for putting up a pilot plant wherever big schemes are envisaged. The pilot plant can be constructed in collaboration with the CPHERI as part of the comprehensive scheme.
17	5·9·6	To foster research work on all problems relating to public health engineering, sufficient money must be ear-marked for operational research.
18	5·10·2	In view of the responsibilities that the Central Public Health Engineering Organisation has to shoulder, it is essential that its status should be elevated and the head of the Organisation should enjoy at least the same status as that of the Chief Engineer in the Central Government.
19	5·10·3	The personnel of the Central Public Health Engineering Organisation should be periodically inter-changed with State Public Health Engineering officers in order to promote better understanding of each other's view points.
20	5·11·1	There is an imperative need for stepping up the production of C.I. pipes of the smaller sizes. Side by side, attention should also be paid to step up the manufacture of C.I. specials.
21	5·11·5	Water meter industry has a great future in the country. It is essential, therefore, that it is built up and promoted on efficient lines in order to get meters of good quality at reasonable cost.
22	5·11·6	A cheap and durable fool-proof device for chlorinating rural water supply should be evolved.
23	5·11·11	Special emphasis is laid on the need for cheap, simple and robust pump suited for rural water supplies as the success of a rural water supply scheme depends upon the quality of the pump itself.
24	5·12·1	The hydraulic pressures in the rural distribution system are not normally high and should therefore permit the use of pipes of cheaper material.
25	5·12·2	A class of pipe lower than the present 'B' class should be manufactured in order to avoid the use of 'B' class pipes everywhere. A judicious use of spun concrete pipes wherever possible will release cast iron pipes for use elsewhere.
26	5·12·6	Every encouragement must be given for the manufacture of pre-stressed concrete pipes in the country after laying down suitable standards and specifications in this behalf.
27	5·13·1	Careful collection of data regarding the daily performance of all existing plants should be enforced as that would be very valuable in designing future expansions and in building new ones elsewhere. The authorities may make proper use of the facilities afforded by the Central Public Health Engineering Research Institute for this purpose.
28	5·13·2	Local Bodies should take steps to impose water and drainage tax where they have not done so and strictly collect the same. This would act as an incentive for the house owners to take connections quickly.

SUMMARY OF IMPORTANT RECOMMENDATIONS—*contd.*

Serial No.	Reference to para	Recommendations
29	5·14·2	The engineers in charge of public health engineering works should use their discretion in designing civil structures with a view to effect maximum economy.
30	6·1·7	The installation of water supply scheme in any urban area makes a sewerage scheme for that area inescapable. It is, therefore, necessary to treat water supply and sanitation schemes as combined utility projects financed on a common basis.
31	6·1·11	For making the schemes self-supporting the cost must have a practical relation to the paying capacity of the local population. A practical way to keep down the cost would be to design schemes with minimum standards to start with, with provisions for expansion at later stages.
32	6·1·14	The method of financing and the agency for executing water supply and sanitation schemes as combined projects will have to be patterned to suit local conditions. Local Bodies in the present status cannot undertake this job. It therefore becomes necessary that a number of municipalities in a region are given the benefit of the services of a Regional Statutory Water and Sewage Board which would act on behalf of these municipalities in the region, taking over such functions and duties from them as are necessary to work the Plan to success.
33	6·4·1	To foster and develop the growth of public health engineering profession, it is necessary to frame now itself rules for registration, licencing and conduct of business. The Union Health Ministry should take action in this behalf.
34	6·5·1	Mapping of water resources in the different parts of the country and laying down policies for its economic and efficient utilisation is a matter of great importance. Equally important is the need for effecting adequate control over pollution of water resources. A broad based Board should be set up for this purpose in each State.
35	7·2·1	The National Water Supply and Sanitation Programme should not only include selective types of supply for groups of villages from a single source but also rural water supply schemes which involve engineering skill and experience either in the development of the source or in the distribution of the supply and its maintenance.
36	7·3·3	The Public Health Engineering Department of the State should be effectively associated with the implementation of rural schemes under different programmes, in order to achieve efficiency and economy.
37	7·3·3	The preparation of basic inventory by each State Government of the rural water supply needs, resources and forecasts is essential. It will be desirable to include in the coming National Census operations, collection of comprehensive data on the present status of the rural national water supply and sanitation facilities.
38	7·4·2	Self-closing taps of robust and approved make should be provided for all stand posts as part and parcel of schemes approved by State and Central Governments, in order to avoid waste of water.
39	7·6·2	It is desirable that the scope of the National Water Supply and Sanitation Programme is modified in order to give more equitable opportunities to urban communities under the loan disbursement. The programme may include a 25% of grant-in-aid for villages or towns with a population between five to twenty thousand. This will give an element of rationale in the aid contemplated under the Programme and would approximate to a slab system of help to the rural, semi-rural and urban population in the country.

APPENDIX I

(Referred To In Para 1.5)

List of works visited and the persons with whom the Panel had discussions.

List of meetings held	Projects studied	Persons with whom the panel had discussions
1st meeting at Delhi on 17th and 18th December, 1958.	Drawing up of the programme.	Secretary, Committee on Plan Projects. Members of the Buildings Projects Team.
2nd Meeting at Lucknow, Kanpur and Sitapur between the 16th and 19th February, 1959.	Water Supply Scheme of Lucknow. Sewerage Scheme of Lucknow. Water Supply Scheme of Kanpur. Sewerage Scheme of Kanpur. Water Supply Scheme of Sitapur, and Village, water supply under WHO Projects.	Dr. Sampurnanand, Chief Minister, U.P. Shri Vichtra Narain Sharma, Minister Local Self Government, U. P. Shri Shripad, I.A.S., Secretary, Local Self Government, U. P. Shri R. D. Varma, Chief Engineer, Local Self Government, U.P. Shri A. K. Roy, Superintending Engineer, Local Self Government, U.P. Shri Mussadi Lal, Chief Engineer, Development Board, Kanpur.
3rd meeting at Ahmedabad between 13th and 15th March, 1959.	Sewerage scheme of Ahmedabad. Grouped water supply scheme-Bhader, and Grouped water supply scheme Sabarmati.	Shri K. M. Kantawala, Municipal Commissioner. Shri V.K. Paranjpye, Superintending Engineer, Public Health.
4th meeting at Bangalore and Mysore between the 16th and 19th April, 1959.	Water Supply Scheme of Bangalore. Sewerage Scheme of Bangalore. Water Supply Scheme of Mysore, and Sewerage Scheme of Mysore.	Shri B. D. Jatti, Chief Minister, Mysore. Shri T. Subramania, Minister for Local Self-Government, Mysore. Shri H. M. Channabasappa. Shri R. C. Srinivasan, Secretary, L.S.G. Shri D. K. Srinivasachar, Secretary, P.W.D. Shri S. Ganapathy, Chief Engineer General. Shri Manchigiah, Chief Engineer Irrigation and Public Health. Shri K. V. Rao, Superintending Engineer, Public Health. Shri T. K. Rama Rao, Superintending Engineer, Water Works. Shri M. Wazir Ahmad, Municipal Commissioner, Mysore. Shri B. N. Kengegowda, President, City Council, Mysore. Shri Narayan Chetty, Mayor of Bangalore. Shri Sampath Ayyangar, City Engineer, Bangalore Corporation.

APPENDIX I—contd.

List of meetings held	Projects studied	Persons with whom the Panel had discussions
5th meeting at Calcutta, Durgapur and Darjeeling, between 15th to 21st June, 1959.	Howrah Water Supply Scheme. Howrah Sewerage Scheme. Calcutta Water Supply Scheme. Calcutta Sewerage Scheme. Water Supply and Sewerage Scheme of Durgapur. Water Supply and Drainage Scheme of the Coke Oven Plant. Waste disposal scheme of IISCO, Burnpur. Composite Water Supply Scheme of Coal Mine Area. Rural Water Supply Schemes near Bagdogra. Water Supply Scheme of Darjeeling. Water Supply Schemes in Sikia, Pokri and Semana blocks. Rural Water Supply Schemes of Kalimpong block.	Dr. B. C. Roy, Chief Minister West Bengal. Dr. A. B. Roy, Minister for Health. Shri P. C. Bose, Chief Engineer, Public Health, West Bengal. Shri R.K. Ray, I.C.S., Chairman, Howrah Municipal Trust. Shri R. L. Sinha, Chairman, Howrah, Municipality. Shri S. Chatterji, Chief Engineer, Howrah Improvement Trust. Shri A. K. Sen, Chief Engineer, Calcutta Corporation. Shri M. J. Bhatt, Chief Engineer, Durgapur.
6th meeting at Bombay, Poona between 4th and 6th July, 1959.	Water Supply Scheme of Poona Cantt. Water Supply Scheme of Poona City. Tinwara Rural Scheme. Shaphada Rural Scheme. Rural Water Supply Scheme of Khede. Water Supply Scheme of Amravati.	Shri D. B. Anand, Chief Engineer, L.S.G. Shri P. V. Ganpule, Superintending Engineer, Public Health.
7th meeting at Delhi on 15th January, 1960.	Issues arising out of the sewerage scheme at Ahmedabad and the rural water supply schemes of Bombay.	Dr. A. N. Khosla, Member, Planning Commission. Dr. S. Seshagiri Rao, Chief, Health Division, Planning Commission. Shri V. K. B. Pillay, Secretary, Ministry of Health. Col. Jaswant Singh, Director General of Health Services. Shri M. K. Kuty, Dy. Secretary, Ministry of Health. Shri K. S. Krishnaswamy, Dy. Director General (Public Health Engineering) of Health Services.

APPENDIX I—contd.

List of meetings held	Projects studied	Persons with whom the Panel had discussions
8th meeting at Delhi, Patiala and Chandigarh between the 22nd and 25th of February, 1960.	Rural Water Supply Schemes at Abul Khorana, Kheowali and Khetbai. Water Supply Schemes of Dakraba and Fatehpur, in Patiala Block.	Ch. Surajmal, Minister for P.W.D. Shri B. B. Vohra, Secretary, B.& R. Shri Balwant Singh, Chief Engineer Public Health. Shri Singal, Superintending Engineer, Public Health. Shri, Hemnani, Superintending Engineer, Public Health.
9th meeting of the Panel at Hyderabad, Madras Trivandrum, Ernakulam and Madurai between 4th and 13th of April, 1960.	Water Supply and Sewerage Schemes of Secunderabad and Hyderabad. Water Supply Schemes of Madras Corporation. Sewerage Scheme of Madras Corporation. WHO Project for Rural Water Supply Trivandrum. Water Supply Scheme of Trivandrum City. Water Supply Scheme of Alleppy. Water Supply and Sewerage Scheme of Ernakulam. Water Supply Scheme of Kottayam. Composite Water Supply Scheme of Kambam Valley villages. Water Supply and Sewerage Scheme of Madurai Corporation.	Shri D. Sanjiviah, Chief Minister, Andhra. Shri L. N. Gupta, I.A.S., Secretary, Department of Health, Andhra Pradesh. Shri Bala Prasad, Chief Engineer, Buildings and Public Health. Shri Thimaji Rao, Deputy Chief Engineer, Public Health. Shri Subba Rao, Deputy Chief Engineer, Public Health. Shri Kamraj Nadar, Chief Minister, Madras. Shri M. A. Manickavelu, Minister for Public Health. Shri M. S. Abdul Quadir, Mayor of Madras. Shri R. Balasubramanian, I.A.S., Commissioner, Madras Corporation. Shri O. T. Raghavan, Special Engineer, Water Works. Shri Bhaskaran, Special Engineer, Drainage. Shri J. G. Abraham, Chief Engineer. Shri M. M. Mani, Superintending Engineer. Shri H. David, Superintending Engineer, Public Health. Shri Velappan, Minister for Health. Kerala. Shri K. E. Epen, Chief Engineer, Public Health Engineering. Shri T. S. Rajagopalan, Deputy Chief Engineer, Public Health Engineering. Mayor of Trivandrum.

APPENDIX I—concld.

List of meetings held	Projects studied	Persons with whom the Panel had discussions
10th meeting in Bihar held between 1st and 3rd August, 1960.	Water Supply Scheme of Jharia. Hazaribagh Water Supply Scheme. Water supply and Sewerage Schemes of Bodh Gaya.	Shri Rajandhari Singh, Mayor, Patna Municipal Corporation. Shri R. P. Golwara, Deputy Mayor, Patna Municipal Corporation. Shri R. C. Sinha, I.A.S., Chairman, Improvement Trust, Patna. Shri K. R. Bhide, Technical Adviser, Public Health Engineering Department, Government of Bihar, Patna. Shri D.N. Jha, Chief Engineer Public Health Engineering Department, Patna. Shri N. P. Sinha, I.A.S., Chief Executive Officer, Municipal Corporation, Patna. Shri I. K. Saran, Town Planner, Patna Improvement Trust, Patna. Shri B. P. Tripathi, Superintending Engineer, Public Health Engineering Department, Ranchi circle. Shri U. N. Jha, Superintending Engineer, Public Health Engineering Department, Patna Circle. Shri M. Choubey, Executive Engineer, Public Health Engineering Department, Dhanbad. Shri D. N. Verma, Executive Engineer Public Health Engineering Department Gaya. Shri Ram Narayan Sharma, Executive Engineer, Public Health Engineering Department, Patna East Division. Shri K. N. Rohatgi, Retired Chief Engineer, Public Health Engineering Department Bihar and now Planning Officer, Patna Municipal Corporation.

सत्यमेव जयते

APPENDIX II

REVIEW OF IMPORTANT SCHEMES

1. *Kanpur Water Supply Scheme*—In 1949, the Kanpur Development Board prepared a comprehensive scheme for the reorganisation and extension of water supply to the city at a cost of Rs. 3.3 crores. This scheme envisaged a supply of 60 m.g.d. to a population of 12 lakhs. The work has been taken up in parts.

In the zonal pumping station, the pumps are placed 12-14 ft. below ground level. In the main water works Pouch Chabal filters had also been installed.

Additional arrangements have been made for pumping raw water but this has not been utilised for want of requisite filtering capacity. The rate of filtration was stated to be 85 gallons per sft. per hour.

Comments

The reservoir at the zonal pumping station could have been circular in shape and of reinforced cement concrete as the rectangular brick masonary tank has not proved to be satisfactory. Placing of pumps 12-14 ft. below ground level is costly and is not necessary in this case. Pumps could have been arranged in a staggered way which would have reduced the space requirements.

The Pouch Chabal filters can be converted into slow sand filters. The possibility of increasing the filtration capacity of the existing filters should be looked into before new plants are put up.

2. *Kanpur Sewerage Scheme*—With the increase in population during and after the war, the existing sewerage system in Kanpur was found to be inadequate. It was considered essential to lay two trunk sewers and some main sewers to serve far flung areas. A complete scheme to cover the present and future expansion was prepared at a cost of Rs. 14.55 lakhs. A short term plan was also prepared costing Rs. 79 lakhs to meet the immediate needs. Work on this plan was taken up in 1955.

At the time of the Panel's visit, 14.4 miles of trunk and branch sewers had been laid. House connections in the sewered area were not progressing satisfactorily.

The disposal of sewage is by farming on land. At times when sewage is not needed for farming, it is led into the river Ganges. Raw sewage is diluted in the water in 1 : 1 ratio and is used for irrigation purposes. Two-thirds of the land is at present under irrigation. It is proposed to extend the irrigation facilities to 10,000 acres. The distribution of sewage is done by bunding.

Comments

Steps must be taken to get the house connections made at a more rapid rate. The sewage farm should be extended to utilise the whole sewage. It is worthwhile to investigate the best crop that may be grown in such a farm. A small team consisting of a Bio-Chemist, a Soil Mechanist and an Agriculturist must study the problem taking some portion of the farm as a model farm. A self-contained laboratory should be attached to the farm.

The distribution of sewage should be through proper channels and regulators. The present method of bunding is not satisfactory.

The Panel was informed that machinery for pre-treatment was available. It will be worth-while if this machinery is put into commission so that pre-treated sewage can also be used for irrigation purposes side by side with untreated sewage and the results watched.

When the farm is expanded, adequate precaution must be taken to provide safety belts around villages in the vicinity. Proper medical care and routine check up should be ensured for workers in the farm.

3. *Sitapur Water Supply Scheme*—The scheme envisages supply of water from tube-wells to Sitapur town at an estimated cost of Rs. 1.55 lakhs. The population of the town is 44,347 and the cost of water supply system per capita is Rs. 30|-.

At the time of the visit of the Panel, connections had been given to 550 houses out of 5,000 contemplated. Out of 18.2 miles of distribution system, 13 miles were laid. There are 34 stand-posts. Twenty-four hour supply is given through the stand-posts also.

Water-tax is levied at the rate of 10% of rental value. Upto this extent, water is supplied free. Beyond this limit, water is charged @Re. 1|- per thousand gallons. According to this the estimated revenue of the municipality works out to Rs. 1.2 lakhs. It was reported that the expenditure on maintenance, repayment of loan and interest will work out to Rs. 1 lakh

Comments

The cost of the water supply system per capita of Rs. 30/- is considered normal. It is gratifying to note that the water supply system will be a profit-earning concern to the municipality. It is also heartening to see that the municipality is eager to go ahead with the sewerage system even without subsidy from the Government.

4. *Ahmedabad Sewage Disposal Scheme*—The Corporation of Ahmedabad has taken up the sewage disposal scheme for the city under the National Water Supply and Sanitation Programme. It has under consideration a comprehensive scheme for expanding the present sewage farm, and providing a preliminary treatment plant at a cost of Rs. 1.25 crores. The sewerage system in the city is more or less complete. The sewage at present is pumped on to a farm. The Corporation owns at present some 2,800 acres of land adjoining Sabarmati river. About 2,000 acres of land is said to be now under use for disposing of sewage on land, either by broad irrigation or mere inundation. A part of the sewage is ponded up in half to one acre plots extending to over 400 acres.

The problem of proper disposal of the city's sewage has been a matter of consideration and controversy for a number of years. In order to improve matters, the Corporation installed during the period 1947—52 a preliminary treatment plant comprising two clariflocculators to deal with 16 m.g.d. of sewage. The provision of a sludge digester was omitted at that time in the hope that the sludge from the clarifiers could be dealt with in open lagoons. Where such a procedure was possible without creating nuisance it became subsequently a matter of controversy. Consequently, the primary treatment plant though installed in 1952 has not gone into operation.

With the increase in water supply to the city, the problem of sewage disposal has become more acute. The Corporation, therefore, has proposed to install clariflocculator, digester, etc. to deal with an additional 32 m.g.d. The estimated cost of the scheme is reported to be of the order of Rs. 70 lakhs.

Side by side with these improvements, the Corporation has also to undertake the execution of works for utilising the sludge gas, extension of new carrier and sub-carrier systems over some 8 miles, in order to distribute the preliminary treated sewage over the extended area of land as contemplated. It is reported that this ancillary work which deserves equal priority with the preliminary treatment works, would cost about Rs. 55 lakhs.

Comments

The problem which demands immediate attention is the total avoidance of river pollution. This is possible only if the entire quantity of sewage is treated on land, and all the year round. For this purpose a large tract of additional land, apart from the 2,800 acres of land available at present, should be brought under sewage farming. And both the existing and the extended areas should be put under scientific system of farming with suitable crop rotations such as would sustain farming operations all the year round, and would prevent the discharge of any part of the incoming sewage into the river at any time.

The public health hazards attendant on sewage farming operations would continue to exist whether the sewage used is untreated or only primarily treated. Primary treatment would no doubt reduce the load on the land in subsequent sewage farming; and the need and extent of such treatment is therefore to be decided with reference to the quality of land available for farming. A very favourable factor for successful treatment of sewage on land in this case is that the soil in the entire area, both the existing as well as the one proposed to be brought under sewage farming, is reported to be sandy and loamy, ideally suited for the purpose. The availability of as much as 400 acres of such land which could be used as stabilisation or oxidation ponds, as an alternative and cheaper method to preliminary treatment of the sewage is a facility with this scheme which could be exploited by the Corporation with advantage. It can be reasonably presumed that treatment in an oxidation pond would achieve a much higher standard of treated effluent eliminating public health hazard that could ever be attained by mere "preliminary treatment" in clariflocculators.

The Panel suggests the following as the most economical and suitable course for achieving the purpose in view at the present stage:

(i) A sludge digester plant and sludge drying beds should be installed as an immediate measure to deal with the sludge out of the two clariflocculators already installed;

(ii) 16 m.g.d. out of the incoming sewage should then be passed through the existing clariflocculators and the settled effluent passed on to sewage farming;

(iii) The remaining quantity of the incoming raw sewage may be put through a series of oxidation ponds as method of treatment and the clarified sewage passed on for subsequent treatment on land.

The above recommendations, if adopted, would help the Corporation in providing treatment for the sewage partly with the two clariflocculators already installed and partly through stabilisation ponds which could be laid out within the area of land already available to the Corporation. It would obviate the necessity for providing mechanical primary treatment through clariflocculators (with sludge digesters also provided) for the entire quantity of sewage for the present leading to considerable saving in the initial outlay as well as in operation and maintenance.

5. *Sabarmati Rural Water Supply Scheme*—The scheme envisages the supply of water drawn from the surface supply from Sabarmati river at an estimated cost of Rs. 91.5 lakhs. It aims at supplying protected water for 50,000 human beings and about an equal number of cattle population at the rate of 10 gallons per head. The cost per capita comes to about Rs. 200. The cost of maintenance comes to Rs. 5|- per head. The scheme has just been started.

The purified water is to be pumped to an overhead tank from where it will be gravitated to a distance of 26 miles through conveying mains designed to carry double the average flow. Branch lines take off supplies from the conveying main to the distribution reservoirs. After 26 miles, again the water from the conveying mains will discharge into a ground level sump from where it is again pumped to an overhead tank and gravitated to a distance of 25 miles. Thus the scheme would provide 50 miles of trunk lines and 100 miles of branch lines. The use of R.C.C. Hume pipes is contemplated.

The Panel had inspected some of the villages coming under the Scheme. In most of the villages there are tanks which have supplied water both for human beings and cattle for a long time.

Comments

The cost of Rs. 200/- per villager is too high. There is no justification for including cattle as beneficiaries of costly water supply scheme.

It was stated that the supply of water from the tanks during summer becomes scanty and saline. However, no data was supplied in support of this view. But the members of the Panel who visited the area were of the opinion that there should be no difficulty in depending upon the existing sources of supply for the cattle.

The pumping mains have been designed for twice the average flow. It was said that 1½ times average supply was taken into account in the design and 0.5 of average flow over and above that was to give water supply at a later date to additional 36 villages in the area which have not been included at present in the scheme on the ground that water supply position there is not acute. The Panel, however, is of the view that the mains should be designed for 1.1 and 1.2 of the average flow according to the hours of pumping proposed and extra allowance on a calculated basis must be provided for giving supply to other villages in future. The provision for additional villages must not be enveloped in the present scheme as proposed.

The overhead reservoirs at Ranjha and Bhadiad are not necessary.

The technical and administrative staff requirements must be carefully worked out and provision made.

A centralised scheme to serve small units over long distances is fraught with difficulties and should, as far as possible, be avoided.

6. *Bhader Rural Water Supply Scheme*—The scheme is for the supply of water to a group of nine villages at a cost of Rs. 12 lakhs. It provides for 10 gallons per day supply to human population and cattle population alike. The cattle population has been assumed as 75% of the human population.

The present population is 8,500 and the design has been prepared for a prospective population of 12,000. The cost per head for the present population works out to Rs. 50/- and that cost for prospective population Rs. 100/-. An infiltration well has been sunk in the bed of river Bhader with two collecting wells located on the bank and a jack well at the end. An infiltration gallery has been laid in-between the wells for a length of 450 ft. A pumping plant has been installed with oil engine sets in duplicate. The duty of the pump has been fixed at about 20,000 gallons against a head of 128 ft. The actual head for the discharge from the head-works to the central service reservoir comes only to 82 ft.

The components at the head-works include a store house. The water from the pump house is pumped into over-head reservoir and a supply from this is radiated to a distance of 8 miles. The distribution system is designed for the discharge of twice the average flow.

Comments

The location of the infiltration gallery perpendicular to the river and mostly on its banks serves no purpose. The inflow into wells which has been arranged through weep-holes provided below curb level is rather unusual. The possibility of the gallery being scoured during floods does not appear to have been considered.

The duty of the pump has been fixed on the high side but it was explained that this was the only pump available. The Panel would therefore like to emphasise that an arbitrary figure in excess of the optimum might either strain the source or reduce the efficiency of the plant. The design of the conveying mains for twice the average flow is quite unnecessary. The provision of an over-head reservoir is also unnecessary when there are distribution reservoirs in the villages.

Inclusion of cattle population as beneficiaries in a costly water supply scheme as pointed out earlier can be called as extravagent.

No satisfactory arrangements for running and maintaining the scheme seem to have been made. The scheme though completed could not therefore be brought into commission.

7. *Poona Water Supply Scheme*—At present Poona City gets 14 million gallons per day from a canal from Khadakvasla. The water is settled in settling tanks and distributed to various parts of the city. One-third of the water supply is pumped to high level areas while the remaining is supplied through gravity to the other areas of the city. There is no filtration. As such, the aesthetic appearance of the water is not

good. The quantity of supply is also inadequate. The Public Health Engineering Department has therefore framed a scheme for getting 40 million gallons per day from a high level canal proposed to be constructed from Khadakvasla dam. The water will be treated through clariflocculators and mechanical filters and then pumped, to a clear water reservoir on the top of a hill and then supplied to various parts of the city. This entails pumping to a height of 120 ft.

Comments

The proposal is only to bring additional quantity of water but it has not been synchronised with the present distribution system. It is of the utmost importance to study the distribution system carefully and see what modifications are necessary to convey this water and include the same in the schemes as otherwise this will lead to idle investment ahead of utility.

There does not seem to be any reason to pump the water to a height of 120 ft. At present only 1/3rd of the supply of 14 million gallons is being pumped to high level areas while the rest is distributed through gravity. It is necessary to prepare a chart showing the distribution system with the head required at different points. Provision of excessive head of water will naturally increase the capital and running cost of the scheme. The department should refix the level of the clear water storage reservoir in such a way that the pumping head is minimum necessary.

The turbidity in the canal water is quite low and as such the extent of clarification that would be necessary may not warrant the installation of clariflocculators as proposed. The filtration rate also can be increased from 125 to 150 gallons per sft. per hour but these have to be studied in greater detail and the scheme modified accordingly.

8. *Water Supply Scheme of Bangalore City*—Bangalore city has a population of 12 lakhs. The daily supply at present is 15 gallons per head per day. To increase the supply to 25 gallons per head per day, the Corporation has taken up big schemes costing Rs. 2.9 crores which envisage increasing the reservoir capacity at T.G. Halli, putting up additional filtration units, provision of pumping main, etc.

The reservoir capacity at T.G. Halli has been increased and additional filtration units have been provided. The work on additional pumping main was not started at the time of the visit of the Panel. The remodelling of city's distribution system has not been included in the scheme.

Comments

The Panel could not help noticing that the successive stages of improvements carried out in recent years lack comprehensive planning and an integrated approach to the problem. The reservoir was there capable of yielding a supply of 25 m.g.d. but actually with the improvements to the scheme so far carried out, the position is that the filter plant as installed can yield 22 m.g.d. while the pumping mains can convey only 14 to 15 m.g.d. The storage avilable is 14 m.g.d. with an additional storage of about 12 m.g.d. at several points in the distribution system. The distribution system itself is in need of radical expansion, improvements and alterations in order to place it on a satisfactory footing. Obviously, a master plan for the city's water supply improvements is a *sine qua non*.

With the filter plant capacity of 22 m.g d. already installed, but with the conveying main and the distribution system not improved to suit, the city is unable to enjoy the fruits of the capital investment on the components which have been improved far ahead of their utility.

The operation of the plant was not satisfactory. Alum dosing was crude. Clarifloccculators have been newly installed and taken over without any means of checking up their efficiency or performance.

The layout of the new filter house was not satisfactory. The thickness of the outer walls and the spacing of the roof trusses do not seem to be economical. The roof trusses have been made to stand over an unusual length of 130 ft. in what appears to be an effort to avoid intermediate columns. It would have been elegant and distinctly economical to provide two rows of columns on either side of the central pipe gallery, and thereby reducing the span of the roof. The structural steel work used in the roof trusses is out of all proportions to the needs of the case. The quality of workmanship in the concrete shell for the filters and the columns and beams was also not upto the mark.

After studying the scheme in detail, the Panel would also like to make certain suggestions for incorporation in the remaining parts of the scheme.

It may be worthwhile to examine the optimum height to which the waste weir should be raised in order to impound the maximum storage for supply to the town in normal and affluent years of rainfall.

The capacity of the existing filters as installed was stated to be 22 m.g.d. based on a rate of filtration of 80 gallons per sft. per hour. By a proper pre-conditioning of the raw water it should be possible to work the mechanical filters at a normal rate of 100 gallons per sft. with an overload capacity of 25 to 30 per cent. The capacity of the existing clarifloccculators would bear a review in order to assess their maximum capacity before any additional plant is to be installed. The existing settling tank of the conventional type could also be re-modelled in order to give better results and to deal with an increased output.

In so far as the triplicate main has been designed to convey all the available additional supply expected from the source to the city, it is desirable to expedite this part of the work without losing any more time. Necessary arrangements for procuring the pipes, specials, valves and other fitments for the entire reach should be made in time so that the execution could be taken up according to a planned programme.

There is at present a clear water storage of about 2 million gallons at the headworks which is roughly 2 hours' storage for the scheme as improved. Normally, with filters rated on a continuous 24 hours basis and with pumping operations extended over the same 24 hours period the clear water storage need only be nominal and not more than an hour's capacity or so. In the circumstances, the need to provide any increased storage for clear water apart from the capacity already available would require to be examined in greater detail.

If an additional storage of 22 m.g.d. should be provided at site as proposed, it may add to the cost unduly without conferring any corresponding advantage. Building up any additional storage at the site would not be of much practical utility in improving the condition of distribution to the city. If at all any additional storage was to be provided, such storage is best provided at the different service reservoir locations in the city.

9. *Water Supply Scheme of Mysore City*—Till recently, Mysore city was drawing its supply from a canal of the Cauveri river at the Belagola pumping station. Raw water from the canal was being pumped through two pumping mains of 14″ and 16″ sizes over a distance of some five miles, to the treatment works located within the city. The daily pumpage was of the order of 5.4 m.g.d. with an installed pump capacity for 12 m.g.d. The total head of discharge was stated to be 400 ft. The raw water is dosed with alum and settled in two large settling tanks. Part of the settled water is passed through mechanical filters while part is supplied direct to the city after chlorination. The quantity of filtered supply is 3.4 m.g.d. while the unfiltered supply was reported to be 2 m.g.d.

The Municipality effected certain radical improvements to its water supply under the First Plan continued into the Second Plan. The improvements comprised a whole-sale shifting of the headworks to the Krishna Raja Sagar site with an off-take from the K.R.S. canal, treatment works, filter plant, and pump house, for a total capacity of 7 m.g.d. The filtered supply was to be pumped to the city through a new pumping main of 24″ diameter over a distance of about 8 miles and discharged into the elevated service reservoir near the treatment works in the city.

Under the first stage of these improvements, estimated to cost about Rs. 48 lakhs, the Municipality has so far completed the pump house at K.R.S. Headworks, the laying of the new 24″ pumping main and the laying of trunk mains within the city, to deal with the additional supply. Some 2½ miles length of the old 14″ and 16″ pumping mains from Belagola were dismantled, and re-used in the city's distribution system for the trunk mains.

As the next stage of improvements, the Municipal Council is getting up proposals for the treatment works at K.R.S. site, and other ancillary components of the scheme at an estimated cost of about Rs. 30 lakhs.

Comments

The present position is that the Belagola source has been disabled by the removal of a part length of the pumping main. The mere installation of a pump house at K.R.S. site has enabled pumping of raw water only of about 7 m.g.d. through the new 24″ pumping main. The old filters for a capacity of 3.4 m.g.d. alone are available in the city for treating the raw water. As a result, after an investment of nearly 50 lakhs of rupees on the improvement scheme, the city continues to get the previous quantity of 3.4 m.g.d. of filtered supply with an increased quota of unfiltered supply to the tune of 3.6 m.g.d. This seems to be a case of irrational planning and uneconomical phasing of expenditure. It has resulted in the investor not getting the full value out of the appreciable investment already made on the scheme.

There does not seem to be any valid reason for discarding the old source of water supply. During the discussions with the Municipal Chairman and Commissioner, the Panel was informed that the Municipal Council has since decided to retain this source also in addition to the new one.

With regard to the installation of new filtration plant, the Panel would emphasize the need for working out the comparative economics of its location at the old site as well as at the K.R.S. site.

10. *Quilon Water Supply Scheme*—The present population of Quilon and some villages in the vicinity is 70,000. The scheme for water supply has been designed to cater to a population of 1.5 lakhs at 30 gallons per head per day. The cost of the scheme was originally Rs. 40 lakhs but that has been revised to Rs. 93 lakhs. The supply is from Sastan Kota tank. The scheme envisages complete filtration units, pumping main and distribution system.

The filtration unit was nearing completion at the time of the visit of the Panel. Portion of the pumping main had been laid. Some works on distribution system in the town had also been completed.

Comments

The scheme is lavish in the sense that it is designed to give 30 gallons per head per day for an ultimate population of 1.5 lakhs, while the present population is only 70,000. All the components will therefore be over-sized and will remain partly utilised for a long time to come.

The washing arrangement for the filters is not satisfactory. The length of wash water flow is long and as such washing cannot be perfect.

The entire pre-conditioning and filtration unit is designed for the ultimate capacity. They could have been properly phased in order to avoid idle investment.

11. *Kottayam Water Supply Scheme*—This scheme has been taken up in the Second Plan at a cost of Rs. 57.75 lakhs. The estimates have, however, been revised to Rs. 73.1 lakhs. The scheme envisages water supply to an ultimate population of 1.5 lakhs, while the present population is 50,000. The supply is from Meenachil river in which the infiltration gallery has been sunk.

The work on the gallery is over and the pumping mains and the distribution system in the town have also been practically completed.

Comments

The gallery will really serve as an infiltration basin. The yield from the gallery has not, therefore, been tested, though it was completed nearly a year back. There is a doubt, whether the gallery would yield the requisite amount of water. If it is not able to yield the quantity required, surface water may have to be taken and treated.

Completion of pumping main and distribution system before ascertaining whether adequate supply would be available is illogical. This clearly shows the lack of adequate investigation. The estimate which has already been revised to Rs. 73.5 lakhs may undergo further radical revision if surface water is to be taken and purified.

12. *Ernakulam Drainage Scheme*—This is a scheme taken up in the First Plan. This is not yet complete. It may spill over into the Third Plan as well. Originally estimated to cost Rs. 60 lakhs, it stands now revised at Rs. 171.23 lakhs. No work on sewer laying has so far been done. Estimates are in progress for laying the sewers. The treatment plant, however, to deal with one million gallons per day has been completed at a cost of Rs. 9 lakhs. A small section of the plant is now being utilised to treat night soil and necessary additional equipment for this purpose has been provided.

Comments

This is an example of bad phasing of components of the scheme. It will take at least 5 years before the town is sewered, pumping stations installed, and sewage brought to the disposal site. Till then, the treatment plant has to be idle. It will be a difficult job to keep the different components of the treatment plant in good condition. In addition to idle investment on capital outlay, considerable amount has to be spent on keeping the plant in a good condition.

The components of the plant do not seem to have been designed on a scientific basis.

13. ***Cumbam Valley Rural Water Supply Scheme***—This is a composite scheme designed to supply water to 8 panchayats at a cost of Rs. 47 lakhs. The ultimate population to be served is 1.5 lakhs. The supply is at the rate of 5 gallons per head per day, for the smaller panchayats and 10 gallons per head per day for the bigger ones.

The water from the Periyar river is pumped to the filtration plant consisting of settling tanks, slow sand filters and clear water reservoir. Water is conveyed to the various villages by gravity over a distance of 20 miles. The sizes of the gravity main range from 14″ to 18″. C.I., R.C.C. and Asbestos cement pipes have been used for the main depending upon pressure it has to sustain.

Each Panchayat has a service reservoir from which water is distributed to stand-posts. Most of the service reservoirs are ground level ones only two being of the overhead type.

Comments

The scheme has a number of good features. The cost is within reasonable limits. The location of intake filter units, etc. has been thoughtfully planned. The size of filter beds has been arrived at in such a way that the perimeter is the minimum.

14. *Madurai Sewage Disposal Scheme*—The disposal of sewage is by farming. The farm extends over an area of 242 acres inclusive of fish ponds. The farm has been laid out on a sloping terrain. The soil and sub-soil at the site comprise mostly of red loam with patches of clay. For filtering the sewage, earthen ware sub-soil pipes have been laid (loose-

jointed) at a depth of about 3 feet and at 33 feet intervals. They are covered over with granite metal and pebbles. These pipes lead into deeper effluent channels constructed at right angles to them. The underdrains have been functioning for the past 30 years or so without much of a blockage.

About 2½ to 3 million gallons of raw sewage are being received daily through the five-mile long 24″ cast iron pumping main. The entire quantity is irrigated in about 25 to 30 acres at a time. The sediments get deposited on the surface of the soil and are collected once a year, amounting to about 5,000 tons. It is a good organic manure for paddy and other crops and is very much in demand.

The sewage irrigated on the plots passes through the soil and is drained out through the sub-soil pipes. The effluent water, about 1½ million gallons daily is very clear and flows outside the farm limits. Recently, however, attempts have been made to partly utilise this outflowing effluent by pumping it back to the farm and mixing it with the raw sewage. Fish ponds have been laid and pisciculture has been introduced jointly with the Government Fisheries Department, after a preliminary study of the adaptability and growth of a number of varieties of fish.

Also the effluent is utilised for diluting the sewage (1 : 6) before irrigation, with a view to securing higher yield of crops. Still a large quantity is flowing to waste. The sanctioned scheme for utilising the excess quantity of effluent for the cultivation of vegetables and food crops is under the consideration of the Municipal Council.

Comments

This is one of the best sewage farms visited by the Panel. The economics of the farm are quite encouraging. The farm has yielded a net profit of Rs. 1.19 lakhs and Rs. 1.38 lakhs in the years 1955-56 and 1956-57.

The farm can well serve as a model for proper and beneficial utilisation of sewage.

15. *Water Supply Scheme of Jharia*—Originally, the water supply to Jharia was from Topchanchi Reservoir. The supply of 2.4 m.g.d. is by gravity.

The Scheme for augmentation of supply was sanctioned in the Second Plan, for Rs. 75 lakhs. This included raw water pumps on the Damodar River, a complete purification plant to deal with 9 m.g.d. and the pumping main up to the service reservoir in Jharia.

The filtration plant is of the Geo Miller type consisting of 2 sets of flocculators, clarifiers and filters which are each capable of treating 4.7 m.g.d. This can be increased to 6 m.g.d. later by increasing the rate of filtration.

The turbidity of raw water is 800 p.p.m. and that of clarified water 12 p.p.m. The turbidity of the filtered water is 7 p.p.m. The alum dosage is 4 grains per gallon. The clarifiers have a capacity of 3 hours. No exact data regarding the filter run can be had as the plant is not running to the full capacity, wash water consumption is reported to be 1½%.

The clear water reservoir under the filter house is of ½ hour capacity and wash water tank above roof has a capacity of 7,000 gallons.

The filter house is a neat structure with shell roofing. The distribution system in the town cannot carry more than 3 m.g.d. A scheme costing Rs. 65 lakhs has been proposed for remodelling and extending the distribution system. This will be taken up in two phases.

The scheme of Rs. 75 lakhs has been financed through the Government of India's grant of Rs. 37½ lakhs and a loan of Rs. 22½ lakhs. The rest was made up from the resources of the Water Board.

Comments

Inlet channels to the raw water pump house need dredging constantly. This is being done manually at present. It would be economical to go in for mechanial dredging.

The filtration plant could have been constructed in two phases. By so doing, it would have been possible to recondition the distribution system also side by side. This would have enabled the population to derive full benefits of the money spent. Construction of the entire plant constitutes an idle investment ahead of utility.

Instead of a separate flocculator and clarifier, a clariflocculator unit would have proved more economical and compact. The clarifiers in this case need be only of 2 hours capacity. Provision of radial launders would have proved more satisfactory. The filter beds occupy larger space than they should. It should have been possible to design them in a more compact way. The washing arrangement of the filters does not seem to be satisfactory. The flow of wash water from the filter is not uniform, resulting in patches of dirt settling down again.

The chemical dosing arrangement is quite satisfactory.

16. *Water Supply and Sewerage Schemes of Bodh Gaya*—Water supply and sewerage facilities have been given to Bodh Gaya under the National Programme. The water supply is from tube-wells sunk near the river Phalgu. The wells are sunk to a depth of 70 ft. and the yield is 15,000 gallons per hour. The water is pumped to an overhead tank and distributed through stand-posts. The water supply scheme covers the surrounding villages also.

A sewerage scheme to deal with 2.5 lakhs gallons per day has also been put up at a total cost of Rs. 3.92 lakhs. Some public latrines and baths have been provided for pilgrims. The sewage is pumped to the plant which consists of 2 primary settling tanks of 1,200 c.ft. capacity, a biofilter, 2 units of final settlement tanks of 1,600 c.ft. capacity, a sludge digestion tank of 12,500 c.ft. capacity and sludge drying beds.

Comments

The yield of the tube-well is satisfactory. The cost of the scheme comes to Rs. 42/- per capita. The cost of maintenance is Rs. 14,600/- per year. The maintenance is done by the Public Health Engineering Department.

The sewage disposal plant is very costly and the same purpose could have been served by simple oxidation ponds. The amount of sewage that comes to the plant is not even a fraction of the design capacity. The design of settlement and open digestion tanks are defective. The cost per capita which works out to be Rs. 98|- is very high. It is unnecessary to go in for such costly plants especially for rural areas.

सत्यमेव जयते

APPENDIX III

(Referred to in Para 2.2.1)

National Water Supply and Sanitation Programme (Urban).

Expenditure Schedule.

Sl. No.	Name of State	No. of schemes approved and their total cost (in Rs. lakhs)									Expenditure up to 31-3-59 on all schemes	Probable expenditure by the end of 2nd Plan	Likely Spill-over to the 3rd Five Year Plan
		Water Supply			Sanitation			Total					
		No.	Original	Revised	No.	Original	Revised	No.	Original	Revised	Rs. (lakhs)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**Andhra**	21	520·23	524·62	4	122·75	122·75	25	642·98	647·37	443·07	647·37	Nil
2	**Assam**	2	79·30	79·30	..	..	..	2	79·30	79·30	5·00*b*	40·00	39·30
3	**Bihar**	12	239·32	261·07	1	47·18	47·18	13	286·40	308·25	188·66†	308·25	Nil
4	**Bombay**	37	593·15	596·10	8	224·79	224·79	45	848·96	989·88	190·66‡	504·80	485·08
5	**Jammu & Kashmir**	3	63·75	63·75	..	..	..	3	63·75	63·75	5·00@	62·57	1·18
6	**Kerala**	5	312·66	546·75	2	110·00	221·23	7	422·66	667·98	245·22	449·05	218·93
7	**Madhya Pradesh**	29	449·42	449·42	3	18·00	18·00	32	467·42	467·42	156·24	200·09	267·33
8	**Madras**	17	697·00	657·70	4	377·63	377·63	21	1074·63	1135·42	401·41‡	538·47	506·95
9	**Mysore**	19	375·12	437·99	7	90·72	90·72	26	465·84	528·71	276·76§	480·65	48·06
10	**Rajasthan**	14	274·13	300·76	..	..	..	14	274·13	300·76	197·64	255·32	45·44
11	**Orissa**	4	121·20	121·20	1	28·11	28·11	5	149·31	149·31	92·80§	149·31	Nil

12	Punjab	46	171·92	216·53	23	112·45	122·63	69	284·37	339·16	158·00‖	299·84	39·32
13	Uttar Pradesh	82	645·65	869·66	17	184·24	275·47	99	829·89	1145·13	764·19‡	916·47	228·66
14	West Bengal	29	336·80	337·16	1	2·35	2·35	30	339·15	339·51	54·02*a*	339·51	Nil
	Total (for States) ..	320	4879·65	5462·10	71	1318·22	1530·86	391	6220·78	7161·95	3178·67	5191·70	1970·25
1	Delhi	3	477·64	477·64	2	532·06	532·06	5	1009·70	1009·70	338·31*b*	1009·70	Nil
2	Himachal Pradesh	6	26·60	26·60	..	..	..	6	26·60	26·60	14·97	26·60	Nil
	Total for Administration ..		504·24	504·24	2	532·06	532·06	11	1036·30	1036·30	353·28	1036·30	..
	Grand Total ..	329	5383·89	5966·34	73	1850·28	2062·92	402	7257·08	8198·25	3531·95	6228·00	1970·25

---

† Expenditure upto 30-6-59.
‡ Expenditure upto 30-9-59.
§ Expenditure upto 30-6-58.
‖ Expenditure upto 31-12-59.
a Expenditure upto 30-9-57.
b Expenditure upto 31-3-58.
@ based on grant, as expenditure is not available.

APPENDIX III—contd.

National Water Supply and Sanitation Programme (Rural)

Expenditure Schedule.

Sl. No. 1	Name of State 2	Estimate approved for			Estimated cost of the schemes Rs. (in lakhs) 6	Expenditure upto 31-3-59 on all schemes Rs. (in lakhs) 7	Probable Expenditure by the end of Second Plan Rs. (in lakhs) 8	Likely spillover to the III plan. Rs. (in lakhs) 9
		No. of Districts 3	No. of Units 4	No. of villages 5				
1	Andhra Pradesh	2	8	780	125·00	105·40	141·13	Nil
2	Assam ..	..	15	1949	84·09	51·50	70·42	13·67
3	Bihar ..	6	12	584	139·46	110·56*	123·28	16·18
4	Bombay ..	8	59	858	300·00	87·74	294·49	5·51
5	Jammu & Kashmir	1	2	3	31·19	16·63†	46·36	Nil
6	Kerala ..	3	11	31	25·90	26·63‡	25·90	Nil
7	Madhya Pradesh	3	7	671	142·70	52·20	105·31	37·39
8	Madras ..	7	8	513	158·55	48·59	103·29	55·26
9	Mysore ..	10	12	180	86·28	28·22	98·44	Nil
10	Orissa ..	12	14	1141	59·04	41·88‡	103·74	Nil
11	Punjab ..	7	80	208	139·65	49·86*	165·98	Nil
12	Rajasthan ..	23	5	4597	99·08	111·67	165·80	Nil
13	Uttar Pradesh ..	..	14	1527	325·63	240·85	318·42	7·21
14	West Bengal ..	10	11	1357	100·87	49·99‡	216·66	Nil
15	Himachal Pradesh	4	39	170	29·27	13·10	36·31	Nil

* Expenditure upto 30-6-59
† ,, 31-3-58
‡ ,, 31-3-57

APPENDIX IV

Flow Charts of Schemes
(Referred To In Para 3.3.6)

Abohar Town Drainage Extension Scheme Estimated Cost Rs. 8,03,647

Sl. No.	Date	Events
1	29-1-1954	Superintending Engineer, Public Health Circle, circulated to the Municipal Committee, Abohar, the National Water Supply and Sanitation Scheme of the Second Five Year Plan and asked the Municipality whether it was intended o entrust the preparation of the scheme to Public Health Division and pay the prescribed fees and if so to send him a clearly worded resolution to that effect.
2	13-2-1954	Municipal Committee resolved that necessary plan and estimates might be got prepared by the Public Health Division on payment of prescribed fees and sent a copy to the Deputy Commissioner, Ferozepur District.
3	8-2-1955	Chief Engineer, forwarded the plan and estimate for Rs. 7,90,266 to the Municipal Committee, Abohar to obtain the administrative approval of the competent authority.
4	7-7-1955	Municipal Committee forwarded the plan and estimate through the Deputy Commissioner to Sanitary Board to accord administrative approval and sanction of grant-in-aid.
5	18-11-1955	Sanitary Board accorded administrative approval for Rs. 7,90,266 and asked the Municipality to apply for the grant-in-aid during the year 1956-57.
6	30-5-1956	Municipal Committee applied through the Deputy Commissioner for the Grant-in-aid from the Sanitation Board for Rs. 31,612 at the rate of 4% of the estimated cost of Rs. 7,90,266.
7	18-12-1956	Sanitary Board accorded sanction for Rs. 15,800 at the rate of 2% of the estimated cost as grant-in-aid.
8	17-4-1957	Chief Engineer, asked the Superintending Engineer, to send the detailed estimate for Rs. 2 lakhs for the first instalment.
9	23-11-1957	Chief Engineer, returned the site plan received on 16-11-1957 to the Superintending Engineer to mark the Municipal Boundary, location of factories etc.
10	4-1-1958	Tenders for work received by Executive Engineer. Estimated cost of the work was Rs. 2,36,080.
11	1-2-1958	Chief Engineer submitted the tender papers to the Government for acceptance at the rates negotiated by him. The rates recommended were as under :— 1. Earth work 300% } Above the contract 2. Other items 190% } schedule of rates. It was reported that high rate was due to increased cost of cement, (Rs. 5-4-0 to Rs. 6-8-0 per bag).
12	4-3-1958	Government approved the acceptance of the tender as recommended by Chief Engineer.
13	14-4-1958	Chief Engineer forwarded a rough estimated cost of the work to the Central Public Health Engineering Organisation of the D.G.H.S.

APPENDIX IV—contd.

Sl. No.	Date	Events
14	23-9-1958	Estimate and plan revised as per discussion with Chief Engineer, and Executive Engineer asked to proceed with the work.
15	14-10-1958	Fresh estimate for the work for Rs. 6,52,358 was prepared by the Superintending Engineer and submitted to the Chief Engineer.
16	8-11-1958	Chief Engineer sent the detailed plans and estimates for Rs. 8,03,647 (Rs. 7,11,192 works outlay and Rs. 92,455 departmental charges) to the Municipal Committee for countersignature in token of approval and return.
17	19-11-1958	Director General Health Services returned the estimates with comments.
18	2-1-1959	Executive Engineer asked the Municipal Committee to hand over the possession of the land belonging to the Municipal Committee leased to private persons for disposal work.
19	12-1-1959	1. Municipal Committee returned the estimate for Rs. 8,03,647 duly approved. 2. Superintending Engineer submitted the plans to the Chief Engineer and requested him to approve the alignment shown therein.
20	18-2-1959	Chief Engineer replied to the comments of the Director General, Health Services dated 19-11-58.
21	13-2-1959	Tenders for the construction of inter-mural outfall and intercepting sewers received by Executive Engineer. Estimated cost was Rs. 2,05,000.
22	10-3-1959	Tenders submitted by the Superintending Engineer to the Chief Engineer.
23	9-4-1959	1. Estimate for Rs. 8,03,647 technically sanctioned by the Chief Engineer. 2. Superintending Engineer submitted to the Chief Engineer tender papers.
24	20-4-1959	Chief Engineer accepted the tender. Accepted rates were 187·50% above the contract schedule of rates.

Water Supply Extension Scheme, Abohar Town

Sl. No.	Date	Events
1	29-1-1954	Superintending Engineer circulated National Water supply and Sanitation Scheme of the Second Five Year Plan to the Municipality, Abohar and requested the Municipality to send him the resolution entrusting the Public Health Engineering Department with the preparation of water supply scheme and to pay the prescribed fees.
2	13-2-1954	Municipal Committee resolved to entrust the preparation of plans and estimates with the Public Health Engineering Department and informed the Department accordingly.
3	12-3-1955	Chief Engineer sent the estimate and plan to Municipal Committee for obtaining the administrative approval.
4	18-4-1955	Municipal Committee considered and deferred the consideration of the scheme to the next meeting.

APPENDIX IV—contd.

Sl. No.	Date	Events
5	30-4-1956	Municipal Committee sanctioned the estimate.
6	31-5-1956	Municipal Committee forwarded the estimate to the Deputy Commissioner, Ferozepur District.
7	31-7-1956	Deputy Commissioner, Ferozepur submitted the plan and estimate for Rs. 6,58,829 to the Sanitary Board for accord of administrative approval and sanction of grant-in-aid of Rs. 27,520-4% of the estimated cost.
8	8-12-1956	Sanitary Board accorded administrative approval for Rs. 6,58,829.
9	26-12-1956	Sanitary Board sanctioned the grant-in-aid Rs. 13,176-2% of the estimated cost.
10	12-5-1956	Chief Engineer asked Superintending Engineer, to submit detailed estimate for the work.
11	23-12-1957	Superintending Engineer submitted to the Chief Engineer, the estimate for Rs. 2,84,233 for the first instalment of amount paid by Municipal Committee.
12	14-4-1958	Chief Engineer forwarded a rough cost of estimate for the work to the Director General Health services for technical approval.
13	26-5-1958	Superintending Engineer submitted the estimate to the Chief Engineer for further action.
14	25-8-1958	Chief Engineer sent the estimate to the Municipal Committee for counter-signature and return.
15	26-8-1958	Chief Engineer sent the estimate for Rs. 5,41,664 to the Executive Engineer for starting the work.
16	19-11-1958	Director General Health Services returned the scheme with comments.
17	12-1-1959	Municipal Committee approved the estimate sent by Chief Engineer.
18	17-2-1959	Chief Engineer submitted to the Director General Health Services, the detailed estimate and plan and furnished the particulars called by the latter in his U.O. dated 19th November 1958.
19	20-2-1959	Chief Engineer accorded technical sanction to the estimate for Rs. 5,41,664.
20	27-6-1959	Chief Engineer returned the plan to the Superintending Engineer duly amended.

Konnagar Water Supply Scheme

Sl. No.	Date	Events
1	2-8-1949	Municipality informed the P.H.E. Directorate of the proposal to take up the water supply scheme and requested for deputation of officers to draw up the scheme.
2	9-11-1949	Chief Engineer, Public Health Engineering submitted sketch project estimate to the Municipality for obtaining the administrative approval of the Government (Rs. 7,02,000).

APPENDIX IV—contd.

Sl. No.	Date	Events
3	18-11-1949	Municipality forwarded the estimate to the District Magistrate and requested him to forward the same to the Sanitary Board for according Administrative Approval.
4	21-11-1949	District Magistrate forwarded the scheme to Commissioner, Burdwan Division to take early steps for obtaining the Administrative Approval of the Government.
5	12-1-1950	Commissioner, Burdwan Division recommended the scheme to Ad-hoc Committee.
6	15-2-1950	Ad-hoc Committee approved the scheme.
7	6-3-1950	Secretary, Ad-hoc Committee forwarded the estimate to Government to accord Administrative Approval.
8	19-9-1950	Executive Engineer asked the Municipality to hand over the site for tube well and pumping station.
9	20-9-1952	Government refused to undertake the water supply scheme due to financial condition.
10	19-5-1954	Chief Engineer, Public Health Engineering requested the Government to take up this work under 1st Five Year Plan of National Water Supply and Sanitation Programme.
11	27-1-1955	Chief Engineer forwarded a slightly revised estimate for Rs. 7,38,000 to the Government for accord of A.A., and to the Municipality for acceptance of estimate.
12	3-2-1955	Municipality communicated the acceptance of the estimate to the Chief Engineer.
13	10-3-1955	Government accorded Administrative Approval.
14	19-5-1955	Estimate for Rs. 7,38,000 sent to Municipality for obtaining final sanction of Government.
15	14-6-1955	Executive Engineer accepted the tender of M/s Indo American Commerce Ltd. for Rs. 13,540 for the supply of pumps (Date of tender 13-5-1955).
16	19-7-1955	Executive Engineer accepted the tender for Rs. 23,000 for supply of 2 Nos. 8″ diameter tube well (Date of receipt of tender 20th April, 1955).
17	19-8-1955	Government called for detailed estimate from the Commissioner.
18	22-8-1955	Tender for the construction of R.C.C. elevated reservoir for Rs. 1,49,276 accepted by Executive Engineer (Date of receipt of tender 8th August 1955).
19	24-9-1955	Commissioner forwarded detailed estimate to the Ad-hoc Committee for recommending to Government for final sanction.
20	22-11-1955	Ad-hoc Committee recommended the scheme to Government.
21	13-1-1956	Chief Engineer requested Government to accord technical sanction.
22	2-2-1956	Government issued notification and called for suggestion or objection upto 17th May 1956.

APPENDIX IV—contd.

Sl. No.	Date	Events
23	7-12-1956	Government accorded technical sanction to the estimate.
24	23-6-1958	Executive Engineer recommended extension of time for the construction of overhead tank. Date of start of work: 1st November 1955. Stipulated *date of completion of work : 29th February 1956.* Work was completed on 31st August 1957. Reasons for extension of time were (*i*) Due to change in site due to bad soil (1m-22 days), (*ii*) Due to delay in procurement of stone chips upto 2nd May 1956, and (*iii*) Due to non-availability of MS rods of required sizes and requisite specials.
25	24-6-1958	Chief Engineer sanctioned the extension of time upto 31st August 1957.

Water Supply of Kheowali Village

Sl. No.	Date	Events
1	8-8-1957	Executive Engineer reported to Superintending Engineer that the Kheowali Panchayat had deposited Rs. 2,000.
2	13-8-1957	Director of Panchayat wrote to Chief Engineer that the Kheowali Panchayat had deposited Rs. 2,000 on 18th May 1957 in the Treasury and it had collected 40,500 bricks costing Rs. 1,600. The Panchayat required one overhead reservoir and battery of taps. Director requested Chief Engineer to submit the estimate for the scheme for acceptance.
3	23-8-1957	Chief Engineer asked the Superintending Engineer and Executive Engineer to prepare the estimate.
4	21-9-1957	Superintending Engineer submitted the estimate for Rs. 60,334 to the Chief Engineer.
5	8-11-1957	Meeting of Chief Engineer, Superintending Engineer and Director of Panchayats. Decided to let out the work to local panchayat on work order basis subject to the condition that the expenditure and liabilities did not exceed the funds at the disposal of Executive Engineer.
6	13-12-1957	Chief Engineer submitted the estimate to the Director of Panchayats to accord administrative approval and intimated that the cash contribution of the villages should be Rs. 3,017.
7	21-1-1958	Chief Engineer submitted the estimate to the Sanitary Board for administrative approval.
8	23-1-1958	Sanitary Board accorded administrative approval to the estimate.
9	13-3-1958	(*a*) Director of Panchayats informed the Sanitary Board that the Panchayat had agreed to bear 12 per cent of the cost, 5 per cent in cash and 7 per cent in the form of labour, in the resolution of the Panchayat Board and the estimate countersigned by Sarpanch was submitted for administrative approval by the Sanitary Board. 5 per cent of the cash contribution was already paid by the Panchayat. (*b*) Director of Panchayats requested Chief Engineer to take up the work early.

APPENDIX IV—concld.

Serial No.	Date	Events
10	23-3-1958	Secretary, Sanitary Board sent the plan and estimate to the Chief Engineer. Grants equal to 38 per cent had already been placed at the disposal of Executive Engineer. The Central Government subsidy would be released as soon as Government of India sanctioned the same.
11	27-3-1958	Chief Engineer asked Superintending Engineer to prepare detailed estimate.
12	14-4-1958	Estimate sent to Director General, Health Services, for preliminary technical approval.
13	6/58	Work started.
14	7-12-1958	Chief Engineer inspected the work and issued technical instructions for the execution of the work.
15	24-12-1958	Chief Engineer asked the Superintending Engineer, about the arrangements made by him about the electric connection to the pumping machinery.
16	15-2-1959	Work completed.
17	17-2-1959	Chief Engineer asked the Executive Engineer to provide suitable drip feed arrangements for chlorination with bleaching powder. After the filters had matured, supply might be given without waiting for opening ceremony.
18	27-2-1959	Superintending Engineer reported to the Chief Engineer that the work was successfully completed by the village Panchayat, where no suitable contractors were forthcoming at the following rates— (1) Earth Work @ 300% above the contract schedule of rates (2) Masonry @ 190% above do. (3) Pipeline @ 150% above do.
19	23-2-1960	Director General, Health Services accorded technical approval to the Scheme.

APPENDIX V

(Referred To In Para 5.4.3.)

Extract from Proceedings of the First Public Health Engineers' Conference, September, 1955.

Data required by the Central Public Health Engineering Organisation for technical review of the Schemes submitted by the States under the National Water Supply and Sanitation Programme.

After full discussion, it was agreed that it would not be possible to give all the detailed information as listed in the data sheet attached to the agenda, as at the same time of getting administrative approval these details are not insisted upon. Some of the States are obtaining sanction of a scheme part by part and as such only one part is taken up for execution at a time. Therefore, a detailed project as per data sheet could only be available after all the component parts of the scheme are taken up for execution.

It was therefore agreed that for the purpose of obtaining Central assistance, sufficient details should be supplied by the States so that general technical scrutiny of the Projects is possible and the Central Organisation can scrutinise the scheme and render any help in the form of remarks which will be of help during execution.

After studying the data sheet, it was agreed that the following should be supplied:

Part A—Water Supply and Water Treatment:

I. *General*:

(a) A preliminary report.

(b) A complete engineering report on the proposed system by the consulting or designing engineer.

(c) A key plan.

(d) General drawings of intake arrangements, pumping stations, reservoirs (storage and distribution) and other appurtenant works.

(e) General drawings of treatment plant.

(f) Estimates of cost.

(g) Mode of financing the scheme where possible.

II. *Details of the above items may be on the following lines* :

(a) Preliminary report:

This should include a statement of problems, present and future needs; available sources of supply and source selected: quality and quantity of supply available; treatment processes proposed with a brief statement of capacities and design data on the major elements; scope of distribution system and distribution storage.

(b) A complete engineering report should contain the following details:

(i) Forecast of future population based on census records, local conditions, social and economic trends.

(ii) Estimation of demands inclusive of domestic, industrial and institutional needs.

(iii) Sources of supply.

1. *Ground water*:

Nature of topography, catchment area, subsoil strata etc.

Construction methods and materials (dug, bored, drilled wells, infiltration wells and galleries, and protection from surface and subsurface pollution).

Minimum safe yield of the source.

Quality of the water with special reference to treatment required, if any.

2. *Springs*:

Nature of topography and catchment.
Details of collection and storage.
Minimum safe yield of the spring.
Protection from surface pollution.
Quality of supply.

3. ***Surface supplies***:

(a) Nature of catchment area and surface geology. Quality of water available, physical, chemical and bacteriological.

(b) Minimum quantity of flow of water available, measures to protect the supply from pollution.

(c) If the minimum flow is short of the daily demands, arrangements for storage, should be detailed supported by hydrological data—rainfall—run off data etc.

(d) Intake arrangements inclusive of low dams, weirs, screens, shutters, collecting wells, galleries and wells.

(iv) A schematic diagram of the supply with hydraulic levels.

(v) Formulae used in determining pipe capacities.

(vi) Description of pumping and gravity mains with hydaulic levels.

(vii) Pumping stations including equipment, capacities main features, provision for future extension, etc.

(viii) Proposed treatment processes should contain the following details:

1. Basis for selection of the process and design capacity of the plant.
2. Chemical mixing and flocculating arrangements, type of structure and equipment with details of detention time, velocity of flow etc.
3. Sedimentation basin with particulars of type, dimensions, detention period, method of cleaning etc.

(ix) Distribution system: General design, data for distribution system.

(e) Key Plan: This should include the layout of the area served and the entire scheme with salient details.

(f) Abstract estimates of cost.

(g) Mode of financing; to be given where possible.
The ability of the community to meet the annuities on the loans floated to raise the capital cost and to meet the annual maintenance charges should be discussed. Also the proposed structure of water rates, metering etc. should be indicated.

Part B—Sewerage and Sewage Treatment:

I. *General*:

(1) A preliminary report.

(2) A complete engineering report on the proposed system by the consulting or designing engineer.

(3). A key plan.

(4) General drawings of treatment plant.

(5) Estimates of cost.

(6) Mode of financing the scheme where possible.

II. *Details of the above items should be on the following lines*:

(1) **Preliminary Report**:

It should usually contain a statement of problems describing present and future areas served with population data for the areas; character and quantity of sewage; proposed site for treatment plant; treatment processes proposed with a table listing type and capacity of all major elements: basic design data such as detention periods in settling basins, filter loading; and description of receiving waters or other means of disposal of effluent.

सत्यमेव जयते

(2) Complete engineering report; this report should include the following:

(a) The nature and extent of existing system, areas to be included within the proposed system and of the areas to be served in future extensions.

(b) A history of growth including forecast of population.

(c) Present total per capita water consumption of the community.

(d) Per capita daily sewage flow based on guagings or otherwise.

(e) Allowance made for infiltration into the sewers.

(f) Estimated daily sewage flow including infiltration.

(g) Character of sewage as determined by laboratory analysis or otherwise.

(h) Principal sources of industrial wastes, if any.

(i) Formulae employed in determining sewer capacities.

(j) Materials for pipes, joints, manholes etc.

(k) Description of pumping stations, including equipment capacities, principal features, provision for future expansion, stand-by unit etc.

(1) On treatment process; the following details should be furnished:

(i) General report of process, design capacity of plant and degree of treatment to be provided.

(ii) General details of principal elements including hydraulic analysis for maximum, minimum and average flows.

(iii) Disposal of effluent.

(a) Description of receiving waters hydrologic data, uses of stream, oxygen resources and bacterial quality.

(b) Disposal of sludge.

(iv) Disposal on land-irrigation use and crops grown.

(v) Disposal of sludge.

(vi) Laboratory facilities and tests.

(vii) Any peculiar conditions of the locality.

(viii) Recommendations for plant maintenance and staff.

(3) A general map of municipality containing the main features of the sewerage system and treatment plant.

(4) Abstract estimates of cost.

(5) Mode of financing the scheme. Details of resources, available and anticipated, to meet the annuities on loans floated to raise the capital cost and to meet annual maintenance charges, should be discussed.

सत्यमेव जयते

L/B447PC—3,000—13-7-61—GIPS